

Integrating Educational Technology in Primary Classrooms:
Purpose and Pedagogy

by

Devon Caldwell

B.Ed., Brandon University, 1999

Graduate Diploma in Special Education, 2004

M.Ed., Brandon University, 2009

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Abstract

Numerous studies have provided information on teachers' beliefs, attitudes, and perceptions of technology integration, the ubiquitous nature of technology and variation in its use, and the barriers experienced by teachers (e.g. Ertmer et al., 2012; Lu et al., 2017; Miller, 2018; Rowsell & Harwood, 2015). However, few studies have offered thorough examinations of Canadian primary teachers' perspectives of and rationales for including specific technologies and digital experiences in their pedagogical practices with young learners. This doctoral study provides in-depth information about primary teachers' technology-supported practices, including pedagogical approaches that have proven successful prior to pandemic teaching and documenting unique approaches to technology integration that have arisen as a response to COVID-19.

Grounded in sociocultural theory and multiliteracies theory, this mixed-methods multiple-case study investigated four Kindergarten-Grade 2 teachers' practices and purposes for integrating technology. Participants were from one rural and one urban school division in Manitoba, and data were collected during pandemic teaching conditions. Findings revealed that although there was variation in teachers' pedagogical beliefs, practices, and device access, there was significant similarity in their purposes for using technology. Common purposes for integrating technology included building community, enhancing teaching and learning, overcoming barriers, and maintaining educational continuity during COVID-19. All participants leveraged a range of platforms and tools to impart digital competencies while endeavouring to balance screentime, creation, and consumption. This study offers suggestions for how primary teachers may integrate technology in effective and innovative ways while documenting the barriers experienced by teachers in their efforts to do so.

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Dedication

I dedicate this dissertation to my nephew and niece, Bowen and Freya. Although Auntie has often been busy with research and writing tasks, I hope that I have modelled for you how important it is to pursue something big, chase your dreams, to persevere, and complete a task. Thank you for always being a very welcome reprieve from the worries and pressure of undertaking such a large project, bringing so much joy to our family, and reminding me of what is truly important in life.

Chapter 1: Introduction

It is undeniable that contemporary teachers and students live and learn in a digital world. From the introduction of the first microcomputers in schools in the 1980s (Feurzig et al., 2011) to the appearance of mobile technologies in 2010 (Kucirkova, 2014), technology has shifted from an optional novelty to ubiquitous in classrooms across Canada. In our current educational climate, three factors are evident when examining technology and its use in schools. Firstly, technology is present in schools, and its use is apparent with all ages of children (Ivus et al., 2020; Nantais et al., 2021). Secondly, all Canadian provinces and territories have integrated technology through their Kindergarten-Grade 12 curricula (Hoechsmann & DeWaard, 2015). Finally, although devices are present and integration is mandated provincially, technology use is diverse with teachers identified as a vitally important factor (Organization for Economic Cooperation and Development, 2015). Therefore, it is important to examine teacher practice in regard to technology integration to truly understand what is happening in primary classrooms.

An understanding of how and why teachers use technology in their classroom practices is essential to understanding technology integration. Ertmer (1999) argued that technology integration could not be measured by counting devices or tracking how many hours they were used. They proposed that observing how teachers used technology to strengthen teaching and learning was the true measure of technology integration. A recent Canadian study indicated that teachers' technology-supported practices are varied (Lovell-Johnston, 2019) with primary teachers integrating technology to support literacy, numeracy, communication, and children's creativity (McGlynn-Stewart et al., 2018; Miller, 2018; Rowsell & Harwood, 2015). However, more evidence is required to explain teacher pedagogy and integration practices in primary settings. Specifically, there is a dearth of Canadian studies that provide specific examples and

detailed descriptions of how technology is used with young children. This discovery formed the basis for my dissertation study.

My research provides in-depth information about primary teachers' technology-supported practices in rural and urban Manitoba during a global pandemic. The goal of investigating this topic was to gain insight into how and why teachers use technology, describe promising practices, and reveal unique approaches to technology integration that have arisen as a response to contexts created by the pandemic. With these purposes in mind and an inability to visit schools due to the pandemic, my research focused on engaging online with primary teachers from one rural and one urban Manitoba school division. I investigated teachers' technology-integrated practices during the 2020-21 school year, with careful consideration given to teachers' mental health due to the extremely challenging pandemic teaching situation.

Therefore, the questions guiding my study are: i) How is technology used in primary classrooms?; ii) What are primary teachers' purposes for integrating technology?, and iii) How has the pandemic shifted primary teachers' technology-supported practices?

Changes to Our World: Global Pandemic

As I developed initial research questions focusing on how and why primary teachers integrated technology, I was unaware that a global pandemic was on the horizon. The pandemic therefore shifted my research questions and data collection procedures. Early in 2020, with impacts continuing to the present time, COVID-19 caused a huge public health crisis that resulted in a major economic crash and significant disruptions to education (Schleicher, 2020). As I drafted this chapter in November 2021, there had been a global death toll of 5.15 million people (World Health Organization, 2021) and the largest vaccination campaign in history was taking place (Bloomberg, 2021). Nearly seven billion vaccines had been administered in 184

countries (Bloomberg, 2021) with vaccinations for children aged 5-12 scheduled to begin (Government of Canada, 2021). Despite the hope and potential protection offered by these vaccines, new variants of concern continued to emerge (Centers for Disease Control and Prevention, 2021).

Educational Continuity during COVID-19

No sector of the global economy has been spared by the broad reach of the COVID-19 pandemic. In March 2020, schools closed around the world, impacting 94% of the world's learners with the largest-ever universal disruption to education (United Nations, 2020). When Manitoba schools re-opened in September 2020, educators were required to offer a combination of in-person and remote learning, reduced class sizes, and countless health measures to safeguard staff and students (Government of Manitoba, 2020). As COVID cases fluctuated from day to day, teachers were called upon to deliver a continuum of responses from in-person teaching to hybrid teaching to emergency remote teaching. This period of constantly shifting and re-evaluating goals, knowledge, skills, and practices and the resulting gaps in students' learning have been categorized as *interrupted learning* (Augustine et al., 2016; UNESCO, 2021).

The quickly escalating COVID-19 pandemic required an urgent response, and educational disruptions of this magnitude were largely unknown in current educators' lifetimes (Schleicher, 2020). With teachers and students unable to occupy the same physical space, technology was identified as a solution for educational continuity. A systematic review and synthesis of emergency learning practices in 48 countries reported that technology use was divided into two categories, Internet-based and non-Internet based, with the Internet-based technologies used significantly more often (Crompton et al., 2021). Teachers around the world were called upon to use technology in new and different ways with all ages of children.

With no warning, the nature of teachers' work shifted dramatically and there were no guidelines or best practices to consult (Winter et al., 2021). Educators were forced to plan, deliver, and assess lessons online with little to no training in online pedagogy or delivery (Schleicher, 2020). Many teachers found themselves ill-equipped to deal with this challenge; a large Organization for Economic Cooperation and Development survey (2018) reported that 40% of teachers had no professional development in technology integration and nearly 20% expressed a high need for further training. With division and provincial resources overwhelmed, teachers faced a critical juncture where they were forced to innovate and examine the untapped potential of technology (Reimers & Schleicher, 2020). In Manitoba, innovative ideas were implemented such as Wi-Fi hotspots in school parking lots, lending mobile Internet sticks and devices for home learning, and collaborations with neighbouring school divisions (Nantais et al., 2021). Teachers relied on platforms such as Seesaw, Google Classroom, Microsoft Teams, and Zoom, and many recorded lessons and instructions for students to sustain educational continuity (Nantais et al., 2021). Although educators developed many unique and worthwhile solutions, it came at a cost to teachers' mental health.

It is no surprise that teacher mental health suffered in these continuously evolving and complex circumstances. In 2020, the Canadian Teachers' Federation (2020) surveyed 14,000 Canadian teachers and discovered that nearly 46% of respondents were concerned about their own mental health and well-being. Sokal, Babb, et al. (2021) documented the increased burnout of Manitoban teachers, finding that nearly half of respondents were experiencing dangerous levels of mental exhaustion and withdrawal during the pandemic. A recent survey of 1206 British Columbian teachers reported that 80.6% of respondents experienced a decline in their mental health, with increased workload due to online teaching demands cited as a contributing

factor (Gadermann et al., 2021). Although researchers such as Barbour et al. (2020) described this current stage as the *emerging new normal*, educators continue to be challenged by the dramatic shifts in the educational landscape.

In this emerging new normal (Barbour et al., 2020), the situation has stabilized to some degree. According to the United Nations (2021), as of September 27, 2021, schools have fully reopened in 124 countries, partially in 44 others, and remained fully closed in sixteen. Eighteen months of pandemic teaching and learning have revealed inequalities such as equitable access to technology devices and Internet bandwidth as well as longstanding disparities between urban and rural locations (Kotak et al., 2021; Nantais et al., 2021). Inequalities that have long existed have been exacerbated by the COVID-19 pandemic, decreasing opportunities for children in rural areas (United Nations, 2020). Although it was a difficult set of circumstances and my original research plans had to be altered, it seemed like an auspicious time to conduct this research in rural and urban Manitoba classrooms.

Defining Terminology

In this dissertation, I use terms that must be defined within the research context. When defining technology integration, an important distinction to consider is educators' professional use of technology versus their instructional use of technology. Similar to Hsu (2016) and Inan and Lowther (2010), I have chosen to define technology integration broadly, encompassing the use of technology (e.g., laptops, interactive whiteboards, digital cameras, robotics, and handheld devices) to support instruction and student learning as well as teachers' professional use of technology (lesson planning and preparation, communication, locating digital resources). Other researchers such as Liu et al. (2017) excluded teachers' professional use of technology from their definitions of technology integration. As technology-supported planning, preparation, and

communication are important components of teacher practice, I have chosen to include teacher technology use in my operationalization of technology integration. *ICT* is an abbreviation for information and communication technologies, which include tools and services such as computers, laptops, applications (apps), interactive whiteboards and flat panels, mobile devices, tablets, cameras, robotics, and the Internet (Manitoba Education, 2016). The terms *platform* and *tool* are used throughout this dissertation. Platform refers to a web-based structure that performs many functions whereas a tool performs a more singular function (Piotrowski, 2010).

The term *primary* is used to describe any Kindergarten-Grade 2 teacher, student, or classroom. *Rural* is defined as small towns, villages, and other populated places with a population less than 1000 people according to the current census (Statistics Canada, 2018). *Urban* is used to describe a large urban population centre of 100,000 people or more (Statistics Canada, 2016c). *Digital divide* refers to the disparities in access to technology across regions or populations; these differences often occur among groups with different socioeconomic levels and between groups in rural and urban areas. These differences include devices as well as services such as broadband internet (Kotak et al., 2021).

Emergency remote teaching is a short-term change in instructional delivery from in-person to an alternative method due to a crisis with the plan to return to the regular format as soon as possible (Hodges et al., 2020). *Hybrid teaching and learning* refers to any combination of in-person and remote teaching and learning activities (Barron et al., 2021). *Online learning management system* is a web and/or application-based platform that provides an online learning interface for teachers and students (Smith et al., 2018). *In-person teaching and learning* is defined as educators teaching children in physical school spaces. *Interrupted learning* describes extended gaps or discontinuities in a student's education (Augustine et al., 2016). *Recovery*

learning is the process that enables students to transition back from remote learning to classroom learning in schools that addresses their mental and physical well-being and academic success (Louis Riel School Division, 2020). Lastly, *school division* describes a group of schools within the same geographical region led by a superintendent and elected school board. In other provinces, the terms *school board* and *school district* are used. For definitions of the hardware, software, and web-based tools discussed in this dissertation, please see Appendix F.

Rationale

My initial reading on technology integration in primary settings revealed a paucity of literature in two areas: i) technology integration in primary classrooms in Manitoba; and ii) teachers' technology integration experiences in rural communities. Due to this reality, it was clear to me that I was well-positioned to contribute to this nascent body of research. For more than 20 years I have worked as a primary teacher, inclusive education teacher, and technology integration mentor in rural classrooms in Manitoba. Technology has been an important aspect of my classroom practice since 2006, and I have implemented and presented on a variety of initiatives, pedagogical approaches, and technology tools. For many years I have been interested in how and why primary teachers choose to integrate technology in their classrooms. When I examined the literature, I learned that there is very little information available on the technology integration practices of Manitoba teachers in rural and urban settings.

Although educational technology integration has been studied extensively, researchers have recommended that more information is needed to explain how and why teachers use technology with students (e.g. Kerckaert et al., 2015; Nikolopoulou & Gialamas, 2015; Tondeur et al., 2013; Vidal-Hall et al., 2020). Detailed accounts of primary classroom practice and teachers' purposes for integrating technology have been described as a newly emerging area of

study (Jeong & Kim, 2017). These findings from the literature echo my own experiences as an educator.

This paucity of research examining how and why primary teachers integrate technology in their classrooms is problematic for several reasons: i) it is difficult to support educators without insight into if or why they choose to integrate technology; ii) it is challenging to plan responsive and relevant professional learning for teachers on this topic; and iii) there is limited information on current practices to inform pre-service teacher education.

As a rural educator, professional development chairperson, and researcher, I am invested supporting the professional growth of teachers in geographically remote areas. It is important to note that the rural Canadian population is growing, and this pattern has been consistent over the last four censuses, with 29% of Canadian residents classified as rural (Bollman, 2017). Reimer and Markey (2008) found that policies developed from research were more successful when studies were place-based and reflexive of local conditions. Thus, as a study situated in both rural and urban locations, my hope is that the findings will be very applicable to a variety of educational sites. As detailed in the next section, a number of stakeholders may benefit from new research on this topic.

Significance

Although technology integration has been an ongoing process in primary classrooms for many years (Ertmer et al., 2012), a digital divide still exists concerning access to technology, classroom practices, teacher preparation, and technology use (Kotak et al., 2021). The current pandemic situation has only made this divide more apparent and critical in education (Kotak et al., 2021). Therefore, in-depth research narratives of teacher practice have the potential to create models of innovation and effective practice that other teachers can draw from to strengthen

practice (Darling-Hammond et al., 2017; Freeman et al., 2017). In addition to guiding individual teachers, research in this area may also play a role in strengthening the development of pre-service and practicing teachers by inspiring well-planned and timely professional learning.

Campbell (2016) posited that relevant research may bridge the gap that is evident in relation to teachers' technology-integrated practice when it is applied in professional learning programs to strengthen theoretical and pedagogical knowledge, understanding, and skills. In order for professional development to shape teacher practice and student learning, it must be grounded in a strong knowledge base informed by research (Darling-Hammond et al., 2017). Furthermore, both practice-based and theory-based research can foster a richer knowledge of the education and development of future teachers (Smith, 2015). A clearer understanding of technology use in Manitoba primary classrooms may assist teacher educators in developing programs aligned with the demands of provincial curricula, emergency remote teaching, and reflect current educational technology practices.

Theoretical Framework

In this study, it was imperative that I selected theories that enhanced understanding of technology use and teacher practice in primary settings. According to Marsh (2015), the theories that have framed studies of young children and technologies are usually derived from psychology, linguistics, sociology, and cultural studies. With those ideas in mind, my research is framed by sociocultural theory (Rogoff, 1995, 1990; Vygotsky, 1986, 1978; Wertsch, 1985, 1989) and multiliteracies (New London Group, 1996). Sociocultural theory (Vygotsky, 1978) is particularly well-suited to exploring the social, cultural, and historical contexts that have shaped teacher practice and the advanced pedagogies surrounding technology integration (Verenikina, 2010) When used effectively, digital technology may result in learning that is more

collaborative, interconnected, and social (Gee, 2010; Jenkins, 2006) for both teachers and students. Teachers' use of technology to create these collaborative and social learning opportunities became particularly important during emergency remote teaching.

In primary classrooms, teachers work closely with young children to move them forward in their learning, with the aim of helping children operate within zones of proximal development. The relationships that take place between novices and experts (such as children's technology use or teachers' development of new skills) are a component of primary teaching practices and align with Vygotsky's (1978) sociocultural theory. As exemplified during COVID-19, the role of the more knowledgeable other is not limited to in-person learning situations. During the pandemic, educational continuity was made possible by teachers and learners gathering in online environments. Even before the pandemic era, teachers and students made use of these spaces for a variety of collaborative projects and learning experiences. Sociocultural theory offers insight into these interactions and collaborations among teachers and students. By connecting with knowledgeable others in these online spaces, there is the potential for meaningful opportunities to engage in rich collaborative learning experiences that exemplify the key aspects of sociocultural learning (Polly et al., 2018). The affordances of technology support collaboration and different ways of interacting in hybrid and online learning environments that may be synchronous and asynchronous (Garrison & Akyol, 2013).

To further enhance and explain my research findings, multiliteracies theory (New London Group, 1996) is also a useful framework. Multiliteracies theory is an applicable lens for examining the different aspects of technology-enhanced teaching, learning, and communicating. This theoretical framework encompasses the interconnections of linguistic, visual, auditory, gestural, and spatial modes of communication, related to each other through multimodal patterns

of meaning (New London Group, 1996). Hesterman (2013) explained that multiliteracies pedagogy is supported by multimodal theory (Kress, 1997) which postulates that children make meaning using numerous modes, meanings, and materials as they interpret and express.

The addition of multiliteracies theory supports the multiple forms of communication, expression, and meaning-making made by possible by technology integration (New London Group, 1996). Digital learning products created in primary classrooms may include linguistic, visual, and audio elements that allow children to share their learning in new and different ways. Lastly, multiliteracies theory (New London Group, 1996) offers insight into how teachers may function as designers of learning environments while classrooms and schools may be seen as sites for media access, learning, collaboration, and creativity.

Dissertation Structure

In the seven chapters that form this dissertation, I describe four teachers' pedagogical influences and beliefs, their attitudes and values in relation to technology, and their technology-supported teaching and learning activities to answer my research questions. Following this first chapter, Chapter 2 explores the history of educational technology and the literature that informed this study. In this chapter, I specifically share current literature on technology integration in primary contexts. In Chapter 3, I provide details on the methodology that guides my research and I describe how I conducted my study. To provide context for data collection, I include a timeline of pandemic teaching in Manitoba. In Chapter 4, I present the quantitative data and vignettes of the rural teachers' technology-supported practices. In Chapter 5, I share vignettes describing how the urban teachers integrated technology in their classrooms. In Chapter 6, I present a cross-case comparison and analysis of the teachers' practices. In Chapter 7, I outline my conclusions, examine the limitations of this work, and share potential areas for future research.

Chapter 2: Literature Review

Technology has enabled enhanced opportunities and connectivity for teachers and students. At the same time, teaching with technology has been described as “a messy and ill-structured process” (Redmond et al., 2021, p. 2897). These realities are reflected in the literature and shed light on teachers’ technology-supported practices. In this chapter, I present a timeline of important events in the development and implementation of educational technology, followed by a review of the literature on primary teachers’ technology integration. Finally, I end this chapter with an examination of pandemic teaching conditions and the repercussions for teacher mental health.

History of Educational Technology

A review of the literature is incomplete without examining the history of educational technology and important events in technology integration with young children. Educational technology in various forms has been used since the time of Confucius and Socrates to support the development of society (Spector & Ren, 2015). Since the advent of the 20th century, the means to accomplish this goal have changed exponentially. Spector and Ren (2015) contended that radio, television, instructional films, and audiovisual tools were important educational technology developments of the first half of the 20th century. In the second half of the century, these tools gave way to large mainframe computers, microcomputers, minicomputers, computer-based learning and instruction, interactive simulations (the forerunner of game-based learning), the Internet, and information and communications technology (ICT). Introduced in the 1980s, ICT was a term that has grown to represent the merging of audiovisual, telephone, radio, television, computer, and network technologies; ICT has had a significant impact on educational technology (Huang et al., 2019).

Several 20th century educational technology innovations were designed specifically to develop literacy skills in young children. For example, in 1924, Freinet developed the Learning Printing Technique (Freinet as cited in Carlin & Clendenin, 2018) that involved young children learning to use an actual printing press to publish their self-composed texts. These texts were bound together to produce class journals and school newspapers. In the early 1960s, Moore (1980) was involved in the invention of a talking typewriter designed to teach young children to learn to read and write. This tool was based on principles of personalization of learning, productivity, and incorporation of young children's perspectives. Twenty years later, Cohen (1988) researched the application of new technologies to support young children's acquisition of written language and/or another language. They used computers with text-to-speech tools in pre-school and primary classrooms and discovered that these tools fostered social interactions and longer, more complex written stories.

Fostering thinking skills and supporting the learning styles of young children have been the impetus behind other educational technology innovations. For example, in the mid-1960s, Feurzeig and Papert (1969) sought to make computers more accessible to young children to foster different styles of learning. With this goal in mind, Feurzeig, Papert, Bobrow, and Solomon (Solomon et al., 2020) developed a Logo programming language to familiarize young children with algorithmic thinking in a playful way. Described as a learning environment where children investigate mathematical concepts and design their own projects, Logo grew to include language, music, robots, animation, and storytelling (Solomon et al., 2020). In 1968, Kay (2002) exchanged ideas with Feurzeig and Papert, leading them to design a template for the Dynabook--an accessible and portable personal computer for children, similar to a book. Kay recommended that it could be connected to a network and allow users to experience text, visuals, animation,

and audio. Four decades later, Kay's template was recognized as the forerunner of the iPad and other handheld tablets (Kalas, 2010).

In 2010, Kay's (2002) vision was realized when tablets, handheld devices, and applications (apps) placed affordable technology in the hands of learners and their teachers. These tools were believed to have the power to transform education because of their portability, ease of operation, and huge variety of educational apps (Kucirkova, 2014; Ritchie, 2014). These simple-to-use apps afforded young children opportunities to create multimedia content and engage in new and different learning experiences (Kucirkova, 2014; Lu et al., 2017). Although tablets and apps have become a staple of many primary classrooms, Kucirkova (2014) reported that as of 2014, these claims of transforming education have not been fully realized or formally evaluated. Kucirkova called for carefully designed studies of iPads in early years education to corroborate these claims, produce meaningful results, and provide pedagogical applications. Many changes have taken place in the last century, and Kalas (2010) provided a clear synopsis of the history of educational technology and young children when he described it as an evolution of learning about ICT to learning through ICT. In more recent years, the introduction of multimodal tablets and whiteboards have made child-friendly technology a reality (Kucirkova, 2014).

As technology has become increasingly ubiquitous over the last 20 years, there is an ongoing discourse surrounding the pitfalls and advantages of technology use with children. Position statements from the National Association for the Education of Young Children (2012) and the Canadian Paediatric Society (2019) outline concerns about the negative impacts of technology in the hands of children. Online safety, media multi-tasking (dividing attention between two or more devices at the same time), increased sedentary behavior, reduced time for

play and interaction, and negative mental health outcomes have emerged as issues to monitor (Canadian Paediatric Society, 2019).

These same position statements tout the benefits of technology in primary classrooms. The integration of educational technology may result in improved academic performance and enhanced literacy and numeracy skills while fostering digital skills, creativity, collaboration, and inquiry (Canadian Paediatric Society, 2019). Technology makes it possible for teachers to document learning, record children's thoughts and stories, and share children's accomplishments using multiple modes (National Association for the Education of Young Children, 2012). Finally, the responsibility of educators to integrate technology has been noted in the literature. In addition to enhancing teaching and learning, classroom technology integration may strengthen children's digital technology skills. Indeed, purposeful integration of interactive technologies in primary classrooms is appropriate and necessary to prepare children for the technological landscape they will encounter in the future (Gordon & Browne, 2016).

Despite the benefits and advancements detailed in this section, the challenge of device access continues to persist in this current chapter of educational technology integration. Although suitable devices exist for young children, disparity in educational technology access may be an issue in some areas of Canada. For example, when researchers from MediaSmarts and Canadian Teachers' Federation (Johnson et al., 2016) surveyed over 4000 Canadian teachers, they discovered that 72% of elementary teacher respondents had interactive whiteboards, 66% were provided with laptops/notebook computers, and 64% had access to desktop workstations. They learned that Kindergarten teachers were most likely to be provided with iPads or other tablet devices. Although there is variation in the kinds of devices available, it is evident that many Canadian teachers have access to technology in some form (Johnson et al., 2016).

In the following section, I provide a summary of the literature examining teachers' beliefs, technology-supported practices, and the barriers they experience as they integrate technology.

Literature Review

The following criteria were used to select research articles for inclusion in this review: (i) published within the last ten years; (ii) focused on early childhood and primary teachers' integration of educational technology in their settings, and (iii) involved educators and teachers of children in early learning centres and Kindergarten-Grade 4 classrooms. Recency was an important consideration when searching for studies due to the constantly changing educational technology landscape and the ongoing impacts of the COVID-19 pandemic. To provide a broad overview of the research as well as specific examples of how and why primary teachers integrate technology, this literature review explores three themes: i) teachers' perceptions and determinants of technology use; ii) teachers' purposes for technology integration; and iii) pandemic teaching conditions, practices, and teacher mental health.

Teachers' Perceptions and Determining Factors of Technology Integration

To develop a thorough understanding of primary teachers' technology integration with young learners, it is essential to examine teachers' beliefs and the various factors that influence technology use. Pajares (1992) described beliefs as extremely personal and difficult to change, developed by chance, life experiences and events, and focusing on oneself and others. When examining beliefs held by educators, one must consider that these perceptions guide teachers' behaviors and ways of thinking in the classroom (Fives & Buehl, 2012). Teachers' pedagogical beliefs, defined as the fundamental understandings and conceptions that teachers hold true about the nature of teaching and learning (Denessen, 2000), are suggested to be powerful predictors of

teachers' technology use (Burke et al., 2018; Tondeur et al., 2017). Pedagogical beliefs encompass teachers' goals, purposes, and reasons for how they use technology in their classroom practices (Prestridge, 2017), and understanding these pedagogical beliefs is an important component of examining teachers' purposes for technology use.

Teachers' beliefs related to technology have been researched extensively (e.g., Cheng et al., 2020; Ertmer, 1999; Ertmer et al., 2012; Ertmer & Ottenbreit-Leftwich, 2010; Hermans et al., 2008; Jack & Higgins, 2019). The following section provides information on teachers' pedagogical beliefs and technology use, orientation of teachers' technology-related beliefs, as well as teachers' attitudes, views, and perceptions related to technology integration. Other determining factors of technology integration, including barriers experienced by teachers and the digital divide in rural and urban areas, will also be addressed.

Teachers' Pedagogical Beliefs. Two types of pedagogical beliefs that are related to the different ways that teachers implement educational technology emerged strongly in the literature. Teacher-centred and constructivist student-centred beliefs are common classifications in the field of educational technology used to explain teacher implementation (Deng et al., 2014). Teacher-centred beliefs are consistent with a didactic approach to instruction; this teaching method involves the direct transmission of information from teacher to student. In a didactic approach, the teacher chooses the topic, decides how it will be taught, and solicits and evaluates student responses (Austin, 2017). Conversely, educators holding student-centred beliefs emphasize the needs and interests of individual learners and classroom practices aligned with constructivism (Piaget, 1928) and social constructivism (Vygotsky, 1978). Although there is an association between teacher beliefs and frequency and type of technology use, one must also consider that teachers hold a combination of innovative and traditional pedagogical beliefs. Innovative beliefs

are student-centred with a modern, information society orientation, whereas traditional pedagogical beliefs have a teacher-directed and industrial society focus (Voogt, 2010).

Kim et al. (2013) investigated teacher pedagogical beliefs and technology integration practices in a mixed-methods study employing surveys, classroom observations, and semi-structured interviews. Twenty-two participants were selected from a group of rural, southeastern US Kindergarten-Grade 8 teachers who had participated in a four-year school reform program funded by the United States Department of Education. Kim et al. (2013) posited that examining teachers' fundamental pedagogical beliefs about teaching and learning was critical to understanding how and why teachers integrated technology. Findings revealed that teachers' fundamental pedagogical beliefs and technology integration were positively correlated. Supported with qualitative data from interviews and observations, they discovered that teachers who favoured student-directed and transformative uses of technology expressed more student-centred pedagogical beliefs. These teachers integrated technology more seamlessly into their lessons and emphasized learning rather than technology tools. A limitation of this study was a failure to account for variation in technology integration practices that may have stemmed from individual differences rather than teacher beliefs.

In addition to the above-mentioned study, Hsu (2016) also showed that technology-using teachers expressed constructivist, student-centred pedagogical beliefs. A mixed-methods case study examined Kindergarten-Grade 6 teachers' beliefs on technology use in the Midwestern United States. One hundred fifty-two teachers completed a 22-item online survey based on McCrory's (2006) framework for high-level, technology-integrated learning. These open-ended survey questions were designed to glean information regarding technology resources in the classroom/school, as well as instructional use of technology. Based on survey results, Hsu (2016)

used a maximum variation sampling strategy (Stake, 1995) to select eight primary teachers from eight different school districts for follow-up interviews and classroom observations.

Analysis of the quantitative survey data indicated that 78% of participants held constructivist pedagogical beliefs about technology integration. Data from interviews revealed that teachers with constructivist beliefs also had a strong sense of self-efficacy and valued technology use. Furthermore, they demonstrated two or more technology-supported practices such as information, representation, and collaboration in their classrooms. Barriers that were named by teachers included teacher/student lack of technology skills, lack of time to use technology in the classroom, and lack of technical support.

Pedagogical beliefs can differ from beliefs about technology. For example, Mertala (2017) examined the nature and foundation of pre-school teachers' pedagogical beliefs surrounding technology use. Similar to the findings of Ertmer et al. (2012), Mertala contended that teachers' constructivist pedagogical beliefs were one of the strongest predictors of technology use. Mertala obtained interview data from 17 Finnish pre-school teachers to study the relationships among teachers' positive pedagogical beliefs, goals, and practices. All participants self-identified as beginners with technology-related pedagogy. Findings revealed that the educators believed that technology could improve education and functioned as a tool for enhancing children's literacy and numeracy development (Mertala, 2017). The participants in the study perceived promising practices as technology-supported whole-class instruction and individual gamified drill and practice activities. This research demonstrated that educators' pedagogical beliefs were constructivist/student-centred, while their beliefs surrounding technology use were traditional/teacher centered.

Another example of teachers' mixed pedagogical beliefs was found in a mixed-methods study by Heitink et al. (2016). Heitink et al. investigated teachers' reasoning about how and why they used technology in their classrooms, discovering a combination of teacher- and student-centred beliefs and practices. Of the 157 teachers who answered the open call across The Netherlands to participate in the study, 117 teachers taught primary grades. Teachers submitted video cases featuring actual examples of classroom technology integration, accompanied by teachers' commentaries on the reasoning behind their instructional decisions. Information about teachers' reasoning and technology integration practices was extracted from the videos with the use of an observation instrument. When submitting the videos, educators also completed a questionnaire to provide insight into how knowledge and beliefs affected their technology use and professional reasoning.

Heitink et al. (2016) found that most learning environments created by participating teachers were more strongly aligned with a transmission or teacher-directed model of instruction. However, teachers demonstrated some characteristics aligned with student-centred practices such as knowledge construction, teacher as a guide, student collaboration, and authentic learning. These classroom practices were consistent with the pedagogical beliefs expressed by the educators in the study slightly more than half the time.

Jack and Higgins (2019) added to the discussion of teachers' beliefs by examining if beliefs had a pedagogical or social orientation. This research was designed to expand on an earlier qualitative study (Jack & Higgins, 2018) to determine if findings could be reproduced with a larger sample. Using convenience sampling, an online survey collected 335 responses from British early childhood practitioners in schools and childcare centres. Survey items focused

on available technologies in early years settings as well as frequency and purpose of technology use. Descriptive statistics (percentages, means, modes) were used to analyze the data.

Hawkrige's (1990) four rationales for technology use (social, vocational, pedagogical, catalytic) were used to categorize respondents' beliefs, with the majority of teachers expressing beliefs consistent with a social rationale for technology use. A social rationale for technology use maintains that computers are pervasive in society and schools need to prepare learners for the reality of a computer-based society. Fewer teachers expressed beliefs aligning with a pedagogical rationale that focused on integrating technology to support teaching and learning. Although teachers with social and pedagogical rationales have a purpose for technology integration, it is beliefs that are consistent with a pedagogical rationale that may strengthen teaching and learning (Jack & Higgins, 2019).

Synergistic Interactions among Teacher Beliefs. Research has revealed that complex relationships exist between teacher beliefs and technology integration practices. For example, Tondeur et al. (2017) analyzed fourteen studies to conclude that there is a bi-directional relationship between teacher beliefs and technology integration. They determined that while pedagogical beliefs influence teachers' technology integration practices, teachers' actual use of technology may lead to the formation of new, more student-centred pedagogical beliefs. Cheng et al. (2020) expanded on this notion by using structural equation modelling to examine the connection between 205 Taiwanese teachers' beliefs and their plans to integrate technology. As previously mentioned (e.g., Hsu, 2016; Kim et al., 2013), teachers with traditional or teacher-centred pedagogical beliefs are less likely to integrate technology effectively. The findings of Cheng et al. (2020) offered new insight into the mitigation of traditional teacher-centred pedagogical beliefs by factors such as teacher competence and perceived value of technology.

The negative impact of traditional pedagogical beliefs is nullified when teachers value technology and feel competent in their ability to use it. In fact, the researchers discovered that when competence beliefs are extremely high (two standard deviations above the mean), the impact of traditional pedagogical beliefs will become positive. This study underscored the synergistic interactions among many of the factors described above; teacher beliefs and technology integration practices are not straightforward. Instead, they are complex, intertwined, and interact in a variety of ways. These new understandings offer explanation for the discrepancies that are sometimes observed between the beliefs expressed by teachers and their actual technology integration practices.

Teachers are Generally Positive about Technology Integration. An examination of the research indicated that teachers are usually supportive of technology integration. The following studies included participants from geographically diverse regions, but many views and perspectives were shared globally among teachers regarding technology use. Jack and Higgins (2019) reported positive attitudes towards technology use among the majority of British early childhood teachers studied. Positive beliefs about technology use in the classroom were echoed by eleven primary teachers located in Cyprus (Timotheou & Hennessy, 2021). Preradović et al. (2017) made a similar discovery when they surveyed 46 Kindergarten teachers integrating technology in a large early childhood education centre in Croatia. Using a quantitative survey instrument to measure educator attitudes regarding technology use at home and school, they discovered that educators understood the importance of developing their own technology competencies as well as the potential of technology to strengthen knowledge and skills in young children. Quantitative survey data indicated that 80% of participating teachers expressed positive attitudes about young children's use of technology while 15% expressed neutral views; the

remainder stated negative views. Teachers reported using technology for planning and research, communication with families, and developing children's information literacy (Preradović et al., 2017). A limitation of this study was the homogeneity of the sample as all participants were located in the same early childhood education centre.

Alkhaldeh et al. (2017) investigated rural and urban Jordanian Kindergarten teachers' perspectives of the role of technology in supporting students' learning. They conducted semi-structured interviews with 30 purposefully selected teachers from all three regions of Jordan. Alkhaldeh et al. (2017) learned that the majority of teachers believed that technology made the learning environment more appealing, engaging, interactive, multi-sensory, and positively enhanced materials and teaching tools. However, teachers expressed differing perspectives on the benefits of technology use by children. Advantages of children using technology, such as enjoyment, school readiness, literacy and numeracy skill development, problem-solving, shared thinking, digital literacy, and hand-eye coordination were expressed by 12 of 30 teachers. Several teachers indicated that technology use with young children had negative outcomes, including overall health and development, poor social relationships, inability to concentrate, and aggressive behaviors.

While Jordanian teachers expressed diverse benefits of young children using technology (Alkhaldeh et al., 2017), teachers in an English study were focused solely on literacy. Flewitt et al. (2015) examined the role of iPads to support children's early literacy development. This qualitative study employed a sociocultural lens to conceptualize the learning taking place. Participants included three nursery, reception, and special education classrooms in suburban central England over a two-month period as they began to implement iPads.

In the initial interviews, all nine practitioners acknowledged the potential of ICT for young children's learning but expressed worry about negative impacts. Teachers perceived technology to have the potential to be expensive, addictive, over-stimulating, and harmful to physical health and fitness. Following iPad implementation, all teachers agreed on three points: i) schools must stay current on technological advancements to prepare children to succeed in a digital world; ii) teachers must adopt a balanced perspective between traditional and new tools and approaches; and iii) educators should capitalize on technology to strengthen teaching practices. Although teachers found that they spent many hours of their own time to plan and prepare technology-integrated lessons, they expressed that iPads provided them with new means of curriculum delivery. Teachers also viewed the iPads as fostering collaboration, communication, motivation, and independent work. The researchers acknowledged that the novelty of new iPads in classrooms could be a limitation of the study.

In the aforementioned studies, teachers shared many common viewpoints and perspectives on technology integration. Teachers expressed the views that technology fosters a positive learning environment (Alkhaldeh et al., 2017), supports student learning (Alkhaldeh et al., 2017; Flewitt et al., 2015; Timotheou & Hennessy, 2021), and strengthens teachers' abilities to deliver the curriculum (Flewitt et al., 2015). Teachers voiced the perspective that it was important to prepare learners for a digital world (Flewitt et al., 2015) and integrate technology to develop collaboration and communication skills.

Teachers Experience Barriers to Technology Integration. It has been suggested that teachers' integration of technology cannot be accounted for by examining isolated factors. Instead, social, cultural, and organizational factors as well as geographic location function interdependently to influence teachers' use of technology (Francom, 2020; Somekh, 2008).

Described as barriers to educational technology integration, these factors are divided into two classifications (Ertmer, 1999; Ertmer et al., 2012; Ertmer & Ottenbreit-Leftwich, 2010). First-order barriers are external to the teacher and may include factors such as: i) support of the school leader; ii) resource barriers such as access to technology, technology support, and teacher preparation time; and iii) access to professional development. These barriers may be considered the first set of obstacles faced by teachers as they attempt to use technology (Vongkulluksn et al., 2018). Second-order barriers are intrinsic to teachers and include: i) teachers' knowledge and technology skills; ii) how to integrate technology appropriately and manage technology-based learning activities; and iii) teachers' beliefs and attitudes regarding the role of technology in teaching and learning.

Although Ertmer (2005) stated that most first-order barriers have been overcome in schools, a recent study of early career teachers from Karchmer-Klein and Konishi (2021) suggested that this may not be the case everywhere. A mixed-methods approach consisting of a survey (50 participants) and follow-up interviews (20 participants) collected data from American Kindergarten-Grade 8 teachers. Quantitative results indicated that many barriers interfered with teachers' efforts to integrate technology. First-order barriers (time constraints and technology access) were identified as the most problematic while second-order barriers (teachers' beliefs about technology and their own competence) were the least problematic. Qualitative data confirmed these findings while revealing that teachers also struggled to stay current on new tools and how to use them (Karchmer-Klein & Konishi, 2021). The following studies presented in the next sections revealed a combination of first- and second-order barriers experienced by teachers in their attempts to integrate technology.

Competing Priorities and Time Constraints. Teachers' time is a limited commodity, and competing priorities make it difficult to consistently integrate technology in primary classrooms. In a mixed-methods study, Australian primary teachers expressed a high level of agreement about the barriers they encountered in their teaching practices (Redmond et al., 2021). A sample consisting of 83 teachers participated in an online survey followed by interviews with four teachers, and 80% of participants stated that the crowded curriculum limited their ability to integrate technology. Three-quarters of participants shared the challenges of competing district and school-level priorities while 70% of teachers maintained that lack of time was a significant issue. According to 70% of participants, technology-based professional development was not identified as a priority by schools and districts, furthering hampering their efforts in integrating digital technologies.

Access to Technology and Skill Development. Determinants of technology adoption of Kindergarten-Grade 12 Australian teachers was investigated by Burke et al. (2018). Using a structured equation model, they examined teacher characteristics and their use of interactive whiteboards. With a focus group of 35 teachers and 156 online survey respondents, questions explored teachers' pedagogical beliefs, concerns with technology, and access to technology. Findings indicated that teachers with constructivist pedagogical beliefs were more likely to use interactive whiteboards. However, the strongest determinant of teachers' technology use was found to be immediate and available access. Teachers who used interactive whiteboards the most were those who prioritized how technology impacted student learning and desired collaboration with colleagues.

Aubrey and Dahl (2014) studied early childhood practitioners' confidence and competence in technology use in a mixed-methods case study approach. A practitioner skills

audit was conducted involving 80 practitioners from 15 rural and urban sites in Northern England and the Midlands. This quantitative audit was followed by interviews with 51 practitioners in a maximum variation sampling. Interviews were analyzed thematically and compared, then a grounded theory approach (Corbin & Strauss, 2008) was employed to categorize themes, issues, and surprises. Ninety percent of practitioners reported a high level of skill in basic computer operations and 84% indicated a high level of skill with Internet use, contrasting with 53.8% stating that they had little or no experience with interactive whiteboards. These results might suggest that practitioners demonstrated higher levels of confidence and competence with technology used in their daily lives, but less so with technology specific to educational settings. Aubrey and Dahl reported that the most significant influence on practitioners' technology use was access to technology and opportunity to practice skills.

Miller (2018) concurred when they observed that teacher skill level and interest were important influencing factors in interactive technology use. Undertaking a small case study in a Canadian Kindergarten classroom, they found that the teacher's interest was even more important than their skill level in integrating technology in numeracy instruction. In addition to teachers' interest levels, the following teacher characteristics also impact technology integration practices.

Teacher Characteristics. Teacher characteristics such as self-efficacy, comfort, confidence, and experience have emerged as factors influencing their technology integration practices. Self-efficacy is the personal belief in one's abilities to successfully execute tasks (Bandura, 1977). While pedagogical and content knowledge are significant factors in teachers' use of technology, self-efficacy may be even more important (Ertmer & Ottenbreit-Leftwich, 2010). Teachers with high levels of confidence in their abilities to integrate technology

consistently did so, even if their knowledge of technology was weaker (Ertmer & Ottenbreit-Leftwich, 2010).

An examination of preschool teachers' beliefs and confidence regarding technology and play contributed to the literature on factors that influence teachers' use. Nikolopoulou and Gialamas (2015) administered a quantitative survey to 190 preschool teachers in preschool and Kindergarten settings in the area of Athens, Greece, to gather data on beliefs about technology and play. Descriptive statistics and factor analysis were used to interpret the data.

Teacher self-efficacy, confidence, and years of experience emerged as important findings. Teachers with high levels of technology self-efficacy and confidence held more favourable views about technology integration. Educators with fewer years of experience expressed stronger beliefs in the role of technology in preschool and Kindergarten settings. Nikolopoulou and Gialamas (2015) concluded that less experienced teachers with higher levels of self-efficacy and confidence demonstrated the most positive beliefs.

High levels of confidence were reported by British early years teachers who integrated technology. Ninety-eight percent of teachers surveyed stated that they were confident using technology personally and 94.5% were confident using it to support children's learning (Jack & Higgins, 2019). Practitioners reported that in addition to confidence, important factors in encouraging them to use technology included curricular outcomes, children's technology capabilities, and access to and amount of equipment. Australian primary teachers also expressed confidence with integrating technology; 69% of primary teachers study by Redmond et al. (2021) expressed familiarity with using digital technologies in their classrooms. Participants underscored the importance of strengthening their personal knowledge and skills as well as their pedagogical knowledge in order to overcome barriers.

These studies (Aubrey & Dahl, 2014; Jack & Higgins, 2019) suggested that the first-order barrier of technology access remains an important determinant of teacher technology use. Beyond simple access to technology, teachers continue to experience first and second-order barriers that limit their ability to integrate technology effectively and consistently (Karchmer-Klein & Konishi, 2021; Redmond et al., 2021). Teachers expressed strong self-efficacy beliefs and confidence in their abilities to integrate technology (Aubrey & Dahl, 2014; Jack & Higgins, 2019; Nikolopoulou & Gialamas, 2015; Redmond et al., 2021) but will be limited in their efforts to do so if first-order barriers such as access, professional development, and time continue to exist.

Geographic Location and the Digital Divide. A discussion of the barriers facing teachers and technology use is incomplete without an examination of geographic location and the digital divide. Although the literature indicated that the rurality of schools may pose additional barriers for teachers, some unique opportunities and benefits are also experienced by educators in these regions (e.g., Francom, 2016; Kotak et al., 2021; Nantais et al., 2021).

Francom (2016) investigated the barriers to technology integration experienced by Kindergarten-Grade 12 public school teachers, comparing larger and smaller school districts in South Dakota. This mixed-methods study relied on a survey of 1079 teachers followed by eleven teacher interviews. It became clear that access to technology was better for teachers of smaller class sizes with greater access problems reported in large urban school districts. Francom also uncovered that technology learning opportunities and access to technology support were similar in both small and large schools with better administrator support for technology integration reported in small school settings.

Rural teachers reported a greater lack of time than their urban counterparts, but time to explore and utilize new tools is an issue for all educators (Francom, 2016, 2020). Time is described as an ever-present barrier to technology integration in Francom's (2020) investigation of barriers in small and large school districts. In order for teachers to design and implement technology-integrated learning experiences, they must have adequate time to do so. Undertaking a time-series survey study in midwestern American Kindergarten-Grade 12 schools, he examined how teachers' perceptions of technology integration barriers changed over a three-year period. An online survey was administered twice over three years with 1906 teachers submitting valid responses. Consistent with findings from an earlier study (Francom, 2016), access to technology and administrative support were more readily available in small rural districts.

Access to technology, administrative support, sophistication of technology integration, teacher attitudes, time, and infrastructure varied for educators in rural and urban areas. The literature illustrated that the rurality of a school influences the barriers experienced by teachers and how they integrate technology in their practices, and this is very evident in Manitoba. Manitoba's school system and its communities have been described as diverse and complex with dilemmas and challenges facing the rural and remote areas of the province (Manitoba Association of School Superintendents & Manitoba Association of School Trustees, 2006). Teaching in rural Manitoba may be isolating with reduced opportunities to collaborate with same-grade teachers and subject-area specialists (Manitoba Association of School Superintendents & Manitoba Association of School Trustees, 2006). These issues are unique to rural areas and the educators who teach there; with 26.8% of Manitoba's total population inhabiting rural areas (Statistics Canada, 2016c) a significant number of educators are affected.

Although technology may function as the antidote to geographic and collaboration challenges, a lack of rural infrastructure may make this difficult. In 2019, Manitoba reported some of the slowest broadband speeds in Canada, with one of the three lowest download speeds measured across the country (Kotak et al., 2021). Coupled with poor service quality and availability, bandwidth-heavy activities such as video calls may be inconsistent or nearly impossible (Kotak et al., 2021).

The most recent and relevant report on the digital state of rural and Northern Manitoba school districts was derived from a two-phase qualitative study conducted by Nantais et al. (2021). A scan of fourteen school districts' websites and social media presence followed by interviews with district technology coordinators examined digital policy, procedures, infrastructure, practices, and challenges. One of the most significant findings of the research was the huge variation in connectivity ranging from fibre in every school to communities without mobile phone service; internet inequity emerged as a major problem. Access to devices also varied across districts dependent on budget and infrastructure. Several districts reported one-to-one devices for students while others struggled with old devices or a lack of devices. Finally, innovative technology integration practices (such as robotics, gaming, and coding) were observed in "pockets" but were not in widespread use. In summary, the varied nature of rural communities is apparent when examining access to ICT and technology integration practices with connectivity posing an ever-present and consistent barrier in rural areas.

The Mismatch between Teacher Perceptions and Actual Practice. Upon consideration of the factors described in the previous section, it stands to reason that teachers' beliefs about technology, teaching, and learning do not consistently translate into their actual classroom practices. Although teachers hold many perceptions about technology integration, this does not

ensure that it will become part of their daily teaching and learning activities (Fives & Buehl, 2012). This is especially evident when researchers uncover discrepancies between teacher self-reports of practice and observations of actual practice. In a mixed-methods explanatory sequential case study of early career teachers, Karchmer-Klein and Konishi (2021) noted a statistically-significant variation between participants' perceived importance of technology integration and their actual classroom practices. Similarly, Timotheou and Hennessy (2021) discovered that although primary teachers expressed that they used technology regularly and in transformative ways, classroom observations did not support these reports. Heitink et al. (2016) observed that teachers' practices aligned with their pedagogical beliefs slightly more than half the time. When considering these discrepancies, one must also consider the tensions some teachers face when grappling with technology integration.

Tensions Experienced by Educators. It is no surprise that some educators may feel tension when confronted with a variety of pedagogical beliefs, discourses, and practices. While studying Finnish early childhood teachers, Mertala (2017) learned that tensions occurred when educators' pedagogical beliefs as related to ICT were compared with more traditional early childhood discourses. These included “good learning is active, but good learning with ICT is inactive” and “good learning is social, but good learning with ICT is independent” (Mertala, 2017, p. 202). Palaiologou (2016) uncovered similar tensions in a mixed-methods study of early childhood teachers in Greece, Malta, England, Kuwait, and Luxembourg. Using an online survey followed by focus groups involving 50 teachers in total, Palaiologou determined that teachers held positive views about technology integration and how it could impact their practice. However, study participants struggled with their understandings of play-based pedagogy and how it held no room for digital devices. Similar to Mertala's (2017) findings, teachers were at

odds with their beliefs of what quality play-based learning looked like and how technology could enhance, rather than detract, from it.

Despite barriers and tensions experienced by educators, the literature base offers compelling evidence that teachers' beliefs about technology are connected to how technology is used in the classroom (Tondeur, 2020). The next section provides a deeper look at teachers' purposes for integrating technology as well as specific examples of classroom technology use.

Teachers' Purposes for Integrating Technology with Young Learners

In the past, some researchers have suggested that technology integration was limited in early years classrooms (e.g., Blackwell et al., 2014; Kerckaert et al., 2015). In a more recent study, Jack and Higgins (2019) discovered that primary teachers used technology for many purposes, making technology integration with young learners more pervasive, diverse, and pedagogically sound than previously thought. Rather than using technology to develop basic ICT skills or to support content delivery, the current research detailed below has revealed that teachers are integrating technology to accomplish a variety of purposes.

A qualitative study of nursery and primary school teachers provided insight into the purposeful ways that teachers of young children integrated technology (Jack & Higgins, 2018). The researchers explored the range of technologies accessible to practitioners and how they were integrated in early years settings. Twelve early years practitioners from eight nursery and primary schools participated in a focus group as well as individual semi-structured interviews. Practitioners reported using technology for the following purposes: (i) to support pedagogical beliefs; (ii) to develop positive learning dispositions in young children; (iii) to document student work and record assessments; (iv) to plan lessons; and (v) to communicate with families. An over-reliance on teacher self-report is a weakness of this study.

Echoing some of the reasons for technology integration proposed by Jack and Higgins (2018), Timotheou and Hennessy's (2021) multiple-case study of Australian primary teachers revealed three reasons for integrating technology: i) to differentiate instruction and change pedagogy; ii) to enhance existing practice through the integration of multimedia; and iii) to support managerial/administrative tasks. My own examination and synthesis of the literature yielded the following purposes for teachers' technology use: i) enactment of pedagogical beliefs; ii) curriculum implementation and skill development; iii) enhancement of instruction and response to student needs and interests; iv) documentation and assessment of student learning; v) planning and communication; and vi) emergency remote learning. The following paragraphs explore teachers' purposes for integrating technology in primary classrooms.

Technology Integration to Enact Pedagogical Beliefs. Lu et al. (2017) found that primary teachers enact their pedagogical beliefs through technology integration practices. A case study methodology was used to study four Kindergarten/Grade 1 teachers' literacy practices in one suburban school in the Midwestern United States. Lu et al. (2017) identified two types of practice associated with the teachers' integration of iPads: teacher-directed practice and developmentally-appropriate, more student-directed practice. When devices were used in a developmentally appropriate manner, the researchers observed student-directed explorations, collaboration, communication, and knowledge construction that was often interdisciplinary in nature. Findings revealed that flexible, responsive instruction as well as differentiation of content, process, and product were made possible through teachers' technology integration. Increased time for individual assessments and preparation and an improved ability to meet learning outcomes and document student progress were cited as important benefits of iPad use.

Tondeur et al. (2013) investigated how six Belgian primary teachers used technology in a qualitative case study. They recognized that commonly-stated barriers (e.g., resources, infrastructure, and teacher skills) failed to explain why most teachers have not integrated technology successfully. Data were generated through observations and stimulated recall interviews of the six teachers' video-recorded lessons. Teachers were not selected based on their teacher-directed or student-centred practices. However, some of the teachers expressed that they used technology to develop learner-centered environments, allowing Tondeur et al. (2013) to conclude that teachers may use technology to implement their pedagogical beliefs. Other purposes for teachers' technology integration included meeting individual student needs through differentiation, research purposes, and to create products such as mind maps. Additionally, technology integration was linked to grade level, curriculum content, and available school resources.

In a study examining teachers' reasoning about technology use, Heitink et al. (2016) discovered that teachers shared only a small number of reasoning categories for integrating technology into classroom practices. Consistent with the findings of studies such as Lu et al. (2017) and Tondeur et al. (2013), participating primary school teachers indicated that they used technology to enact pedagogical beliefs and deliver curricular content or to support pedagogy alone. Participating teachers explained that their reasons were linked to making learning engaging for students, achieving educational goals, and strengthening the learning process.

Curriculum and Skill Development. Common purposes for integrating technology are to develop important skills and implement curricula. Conducting a quantitative study of 232 early years teachers (pre-school to Grade 3) in Flanders, Belgium, Kerckaert et al. (2015) administered a survey to investigate teachers' purposes for technology integration and frequency

of ICT use. Results indicated that participating teachers integrated technology for two purposes: (i) development of basic ICT skills and (ii) to support curricular content and student needs. It was discovered that the first type occurred more frequently than the second. Findings indicated that teachers integrated technology more frequently in Grades 2 and 3 and less often with younger children in Kindergarten and Grade 1.

While often used to support literacy development (Flewitt et al., 2015; Lu et al., 2017), technology integration may also strengthen numeracy instruction and result in higher levels of student engagement. Miller (2018) used a single mixed-methods case study design to explore the role of interactive technology in the development of numeracy skills in a play-based learning environment. A Kindergarten classroom in rural Canada with thirteen children and one teacher was introduced to iPads for the first time during this study. After one week of using the iPads at learning centres, the children were divided into two groups for a two-week period. The first group used 15 numeracy apps for two weeks with the teacher-trained research assistant while the second group engaged in regular play-based numeracy lessons led by their teacher.

Field notes documenting conversations during teacher training sessions and observations of students using iPads generated quantitative data. Children's numeracy testing scores were tracked as quantitative data to measure if iPads supported numeracy skill development. Miller (2018) discovered that using interactive technology such as iPads to implement the Mathematics curriculum and support numeracy instruction led to small gains in numeracy skills and high levels of engagement. This small single-case study provided rich description of how technology was integrated in a rural Canadian setting.

Enhancement of Instruction and Response to Student Needs and Interests.

Technology may play an important role in individualizing and strengthening instruction as well

as increasing teacher capacity to respond to student needs and interests. Milman et al. (2014) studied how iPads were used in a pre-Kindergarten to Grade 4 elementary school in the United States. This mixed-methods case study used a sequential qualitative to quantitative design with seven pre-Kindergarten to Grade 4 teachers participating in over 50 hours of classroom observations. At the end of the school year, three students from each grade level were interviewed to document their experiences of technology integration. Corbin and Strauss' (1990) conditional matrix was used to analyze qualitative data. Quantitative data was obtained through a web-based survey to learn more about teachers' use of technology, as well as their beliefs and attitudes.

Milman et al. (2014) discovered that teachers integrated iPads to meet individual student needs by differentiating content, process, and product in their primary classrooms. They also used technology to enhance instruction, fostering an interdisciplinary approach that combined two or more subject areas in one lesson. The researchers noted that technology use provided new opportunities as students created digital books and field journals featuring Science and Social Studies content. Teachers also strengthened assessment practices by using technology to capture and share students' work samples with families. The survey responses of technology specialist teachers as well as more observation time in certain classrooms were cited by the researchers as potential limitations of this study.

Masoumi's (2015) research yielded similar findings when he investigated the ways in which teachers integrate information communication technology (ICT) in Swedish preschools. Masoumi used a multiple case study approach based on Yin's 2009 work (Yin, 2009) to gain insight into six teachers' uses and perspectives of technology in their pre-school practices. Employing ethnographic methods, the researcher engaged in unstructured thematic interviews

with teachers (one per teacher) and classroom observations of children aged four-five years. Rich data were generated through three weeks of daily observations at each of the three sites. Data analysis focused on pre-school teachers' actions, key interventions in using technology, and technology-enhancing pedagogical practices through the development of categories, themes, and patterns.

Concurring with Milman et al. (2014), results indicated that teachers used technology in pre-school settings to enrich and transform curriculum and classroom practices and to communicate and document student learning. Masoumi (2015) also found that technology was integrated for these purposes: i) to foster cultural literacy and create inclusive learning environments for immigrant children; ii) to keep children occupied; and iii) to communicate and document classroom practices.

In their efforts to respond to students' interests and needs, teachers may turn to technology for self-directed professional learning. Social media tools such as [X](#), formerly known as Twitter¹, offer a wealth of easily accessible information on any topic as well as a sense of community for educators. Using an online survey of 755 educators (ranging from Kindergarten to higher education), Carpenter and Krutka (2015) found that teachers' use of Twitter for self-directed professional development was efficient, interactive, and readily available. Participants expressed that this free social media platform also provided an online space for connecting equally with people of similar interests as well as those with diverse perspectives.

¹ Twitter was acquired by X Corp, owned by Elon Musk, and underwent a formal name change to X in July 2023 (Ivanova, 2023). Since this social media platform was known as Twitter during participant interviews and the writing of this dissertation, it is referred to as Twitter throughout this dissertation.

Other studies echoed similar findings describing the high value educators placed on Twitter for professional learning and connection. In a mixed-methods study of 542 Kindergarten-Grade 12 educators who used Twitter, Visser et al. (2014) learned that teachers relied on Twitter for self-directed professional learning as well as connections with other educators. Respondents related that their use of Twitter positively impacted their classroom practice through increased classroom collaboration and enriched student learning (Visser et al., 2014). Using a two-phase mixed-methods approach that included an online survey followed by semi-structured interviews, Nochumson (2020) investigated what teachers learn from using Twitter and how they use that information. Findings indicated that Twitter's microblogging platform was leveraged by educators to gain new technology integration ideas, to strengthen their teaching practice, and to share inspiration and information in a supportive community (Nochumson, 2020). These studies speak to the need for as well as the value teachers place on the self-directed, free, and accessible professional learning made possible by technology.

Assessment and Documentation of Student Learning. Technology tools and applications have unique affordances that are well-suited to documenting, sharing, and assessing student learning. Assessment practices may be strengthened by documenting and sharing student work with technology (Masoumi, 2015; Milman et al., 2014). Danniels et al. (2020) investigated Ontario Kindergarten teachers' perspectives and practices related to technology-supported assessment. Using a qualitative research design to study 20 play-based Kindergarten classrooms, interviews, observations, video recordings, and video-elicitation interviews were used to generate data. Of the 26 educators studied, three did not use technology for assessment, 17 used technology to increase efficiency, and six used technology to assess in new and different ways.

Participating teachers' preferred tool was an iPad with the Seesaw² application which allowed them to document students' play-based learning; this was especially beneficial in terms of capturing a process rather than a finished product.

Teachers in 11 classrooms used technology to support summative assessment, making it easier, quicker, and more efficient (Danniels et al., 2020). Other teachers described how they used to technology for assessment as and for learning. In some cases, individual students used technology independently to keep a record of their own learning. This study demonstrated the role of technology in play-based assessment as well as teachers' positive views of technology integration in the assessment process. The next section provides more in-depth details of how teachers of young children use technology in their practices.

Examples of Teacher Technology Integration. Technology integration practices vary from classroom to classroom, encompassing everything from keeping children occupied with apps and games (Masoumi, 2015) to global collaborative projects (Carpenter & Justice, 2017). It stands to reason that the benefits of technology integration are linked to how it is used; Marsh (2015) noted that when young children were provided with appropriate technology in their learning environments, a variety of skills and knowledge were developed while engaging children in meaningful, agential interactions. Although these are not representative of all the ways that teachers use technology, the following examples highlight how technology integration may support and strengthen children's play practices, literacy skills, creative and computational thinking skills, and collaboration and communication skills.

² Seesaw is a multimodal learning platform designed for student, teacher, and parent/guardian use (Seesaw: Where learning happens, n.d.). Free and premium versions are available that allow the creation, documentation, and sharing of work samples and learning portfolios. Communication and feedback are enabled through comments, teacher-parent messaging, and an integrated blog.

Playful Digital Learning and Play-Based Pedagogy. It is interesting to consider that perhaps children's play has not changed greatly over the centuries. Saloni-Pasternak and Gelfond (2005) argued that digital play was "the first qualitatively different form of play that has been introduced in at least several hundred years" and "it merits an especially careful examination of its role in the lives of children" (p. 6). There is a growing body of literature surrounding how children's play has changed to integrate digital elements, including how children learn to use technologies through play (e.g., Edwards, 2015; Marsh, 2015; Marsh et al., 2016).

With the goal of designing their own digital play framework, Bird and Edwards (2015) conducted a case study of an early childhood classroom of 20 four- and five-year-old children in Melbourne, Australia. Data were collected through written observations, video recordings, and examination of the recordings and photographs created as young children learned to use the iPads and cameras through play. Analysis was conducted by using a play framework including exploratory, problem-solving, skill acquisition, symbolic, and innovation behaviors.

Findings indicated that play-based technology learning started with exploratory use of the device, to finding and correctly using the features of a device, to understanding the device's capabilities, and then deliberately using the device to execute a plan. When this intentional use began, children were able to use the technology to support and advance their play in innovative ways. Ludic (innovative) play led to the most transformative use of technologies in early childhood when children began to create new content using multiple modes (Bird and Edwards, 2015).

Palaiologou (2016) studied the integration of digital devices in children's play and the attitudes and aptitudes of early childhood teachers. She noted that cultural meaning-making was

strengthened by children's digital play and recommended that teachers make digital devices accessible to children as tools to expand possibilities in play. Danniels et al. (2020) added to this discussion with their investigation of documenting and assessing play-based learning using iPads and the Seesaw application. Whether play was captured by individual students or teachers, this digital documentation allowed teachers to examine how curricular concepts were integrated into play. Valuable shifts in play-based assessment practices were made possible by integrating technology in children's play.

Creative and Computational Thinking Skills. Teaching and learning may shift when technology is integrated to foster creativity and invention. In a two-year Canadian government funded research project, Rowsell and Harwood (2015) investigated how young children made meaning and created and invented with iPads. Five programs and classrooms were included in the study: two community-based childcare settings and three full-day Kindergarten classrooms. Visits occurred on a bi-monthly basis over a seven-month period before and after iPads were introduced to the students. Online surveys were used to gather information from teachers and parents about literacy practices.

Rowsell's and Harwood's (2015) research was framed by multimodality (Jewitt, 2006; Kress, 2010) as well as Certeau's (1984) theory of productive consumption. These theories provided a useful lens for examining the children's desire to consume as well as produce texts related to an extremely popular animated children's movie. Rowsell and Harwood found that when iPads were introduced to these early childhood settings, children had many more options for blending, consuming, and producing as they explored their favourite movie. Using iPads, children made more diverse meanings and switched between modes of communication with ease. Rowsell and Harwood observed that children shifted into new and different ways of being and

knowledge-making and brokering when an iPad was available to them. Children were inspired to recreate their favourite movie literally as well as culturally.

Rowsell and Harwood (2015) concluded that when teachers and other adults are willing to change their teaching practices, children's creativity can be positively impacted by technology. In the above case, the teacher moved away from a more traditional teacher-directed practice to student-centred, co-constructed learning (Rowsell & Harwood, 2015). This study demonstrated how technology can foster creativity in young children when teachers are willing to release control and be guided by students' interests.

Global Collaborative Projects. As mentioned above, teachers and students may use technology to develop important skills, but technology-based collaborations can extend learning beyond the classroom. Hopper (2014) conducted a case study of Kindergarten-Grade 4 classrooms in a Texas-based school that implemented global collaborative learning projects through videoconferencing. With teacher and administrator collaboration, a rubric was developed to identify characteristics of effective projects and provide a framework for improving videoconferencing experiences. The rubric was used as a guide to strengthen the collaborative projects, and each project was scored when it concluded. Learning objectives, student interaction, cultural diversity, communication tools, and effectiveness of technology were rated from 0-3, with a total score of 15. Data included an anecdotal account of each project as well as a final rubric score.

Teachers and administrators expressed goals of improving student interactivity and engagement while integrating 21st century skills into existing curricula through these global collaborative projects. Students and their teachers connected with international partners through synchronous videoconferencing tools such as Skype and asynchronous collaborative tools such

as wikis and blogs. Teacher confidence in the content area of the global project was key; this allowed them to focus more strongly on the project-based learning approach and details of the actual collaboration (Hopper, 2014). Topics explored by nine Kindergarten-Grade 4 classrooms included butterfly migration, phases of the moon, communities around the world, and climate and growing and conditions. Projects typically lasted several months to the entire school year depending on the topic studied. Although this case study provided a valuable account of how technology was leveraged by teachers for collaborative learning projects, important details of the research were missing. Hopper (2014) failed to relate who completed the rubrics and how the anecdotal accounts of the projects were obtained. More rigorous methodology is required in future studies in this important area.

Some collaborative projects blend literacy and technology to foster connections among teachers, students, and schools. “One book to connect the world” (Ripp, 2019a) is the premise of a global project called *The Global Read Aloud*. Developed in 2010 by Wisconsin teacher Pernille Ripp, this free project uses a website, blog, and Facebook groups to connect teachers and students as they read the same books at the same time. Three authors are usually selected for three categories: picture books, early chapter books, and young adult chapter books. The actual collaborative project takes place in the month of October, and Ripp provides a weekly schedule for books or chapters to read. The rest of the project is self-directed by teachers, allowing for variation in how teachers and students engage with the text and other classrooms (Carpenter & Justice, 2017).

Carpenter and Justice (2017) investigated the role of digital technologies in students’ and teachers’ The Global Read Aloud experiences. They created a 27-item anonymous online survey to collect quantitative and qualitative responses regarding the experiences of teachers as well as

their perceptions of these experiences. Responses totaled 516, with teachers from 14 countries (94% from North America) completing the survey. The largest group of respondents were primary teachers, with 85% self-identifying as proficient users of technology. Teachers' perceptions of The Global Read Aloud were overwhelmingly positive, with 97.9% selecting a positive rating on the survey. Educators reported using Twitter, Padlet, Skype, Edmodo, Google Drive, Google Hangouts, blogs, and email as important technology tools in the collaborative reading project. Synchronous collaboration took place through Skype and Google Hangouts as classrooms read and discussed books together, with 79% reporting that they took part in at least one video call. Respondents were enthusiastic about these face-to-face digital connections that fostered meaningful conversations and social construction of knowledge. Asynchronous tasks were facilitated through Twitter, Padlet, Edmodo, and blogs; these were important tools in connecting classrooms in different time zones. Twitter and Padlet were identified as teachers' most-used tools to discuss books and share information among collaborative partners. Common challenges shared by participating teachers were using technology effectively, access to technology, and school/district policies that blocked certain technologies. Carpenter and Justice (2017) commented that the voluntary nature of The Global Read Aloud and teachers' ability to choose how and with whom they collaborated fostered teacher autonomy.

As evidenced by the above examples from practice, teachers may integrate technology to foster collaboration and connection, develop a love of reading, strengthen creative and computational thinking skills, and enhance play-based learning and assessment. Typically, Manitoban teachers enjoy a great deal of professional autonomy (Manitoba Education and Training, 2019) and choose if, when, and how they integrate technology. This means that teachers themselves decide if they wish to teach coding, participate in collaborative projects, or

include aspects of digital play in their practices. This freedom and choice surrounding technology came to a sudden end when the COVID-19 pandemic compelled teachers to use technology to deliver emergency remote learning (Schleicher, 2020). The third and final theme of this literature review examines teacher practice during the pandemic and the subsequent effects on teacher mental health.

Teaching during a Pandemic: Pandemic Pedagogy and Teacher Mental Health

In this section, I share current research that provides insight into some teachers' practices, tools, and experiences during COVID-19 global pandemic. Internet and library searches over time yielded an abundance of research investigating pandemic education policies and mental health. A smaller amount of literature was available on the experiences of families and children during pandemic/at-home learning. There is a paucity of research describing actual accounts of primary teacher practice during the pandemic and teachers' technology-supported teaching and learning activities.

Teacher Practice during Emergency Remote Teaching. Almost without exception, pedagogical approaches, subject areas, lesson delivery, and assessment practices were altered during the transition to emergency remote teaching. Decoito and Estaiteyeh (2022) investigated the online teaching practices of 75 Kindergarten-Grade 12 Science/STEM teachers in an undisclosed Canadian province during the spring of 2020. More than half of the participants were elementary teachers. An online questionnaire was used to collect qualitative and quantitative data on their practices surrounding curriculum planning, implementation, and assessment. Teaching strategies used online were more traditional and teacher-centred, focusing on content delivery over student choice. The most commonly implemented assessment practices were traditional tests and quizzes with 76% of teachers describing their assessment practices as

ineffective. According to 59% of participants, their online teaching methods were less creative than their in-person practices. An inability to differentiate instruction and support all learners was reported by 56% of teachers. Decoito and Estaiteyeh (2022) concluded that the need for content delivery was prioritized over high-quality teaching and learning practices. It is no surprise that most teachers believed that online teaching negatively impacted their learners in engagement with peers (60%), engagement with teachers (46%), and student achievement (42%).

An examination of Kindergarten teaching in Ontario during the first wave of COVID-19 highlighted the challenges faced by educators in shifting pedagogy and adapting activities for online learning. Spadafora et al. (2022) used quantitative scales and qualitative open-ended questions to generate data for a descriptive study of 2569 Kindergarten teachers' emergency remote teaching experiences. A strong theme that emerged was teachers' frustration in their inability to implement a play-based curriculum in an online setting; 80% expressed how difficult this was. Educators shared their struggles in adapting lessons for online teaching; only half of teachers reported that they had the necessary resources to teach online. Meeting the needs of learners with diverse needs was also an issue with 77% of teachers reporting this as a significant barrier (Spadafora et al., 2022).

A combination of synchronous and asynchronous teaching and learning activities were implemented by Kindergarten-Grade 2 teachers in Ontario during emergency remote teaching. A qualitative, interview-based study was undertaken with 25 educators and 11 parents from April-June 2020 (Timmons et al., 2021). In some cases, teachers' instructional delivery method was mandated by local school boards; synchronous delivery allowed teachers and students to connect in real time while asynchronous delivery involved posting content and activities for students to complete at their own pace. Benefits of both approaches were expressed by the participants;

synchronous learning activities supported children's relationships and social-emotional development while asynchronous delivery facilitated access to technology. In homes with only one device and multiple learners, children could take turns using the device to complete schoolwork. A blend of both methods with access to live lessons considered a bonus was regarded as the best solution by some participants. A lack of differentiated instruction was identified as a concern by parents, while teachers expressed dismay with assessment practices. Teachers felt that assessments were inaccurate as it was impossible to determine how much help children received from their parents (Timmons et al., 2021).

Although drawn from only a handful of studies, commonalities are clear across these accounts of emergency remote teaching. Teachers generally expressed dissatisfaction with their online pedagogical practices, describing them as teacher-centred and lacking creativity (Decoito & Estaiteyeh, 2022), inconsistent with play-based pedagogy (Spadafora et al., 2022), and lacking differentiation to support diverse learners (Decoito & Estaiteyeh, 2022; Spadafora et al., 2022; Timmons et al., 2021). As described in the next section, these similarities extend to the tools used by teachers for online teaching and learning.

Online Teaching with Technology. During emergency remote teaching, teachers selected platforms and tools that were accessible, easy to use, and familiar. Indonesian teachers relied on online tools available on parents' mobile phones and computers to provide emergency remote learning during the first wave of the pandemic. A qualitative case study of 67 primary teachers used surveys and follow-up interviews with 10 educators to examine their practices and perceptions of online teaching (Rasmitadila et al., 2020). Teachers made use of accessible tools such as Google Classroom, WhatsApp, and Zoom to communicate with students and their families. **Learning videos sourced from YouTube** or created by teachers themselves were the

most used form of instructional media, with Google Forms and digital worksheets used to obtain student responses. Teachers depended heavily on question-and-answer approaches to measure student learning (Rasmitadila et al., 2020).

Canadian K-12 Science/STEM teachers reported using online learning management systems in their remote teaching activities, naming platforms such as Brightspace, Microsoft Teams, Google Classroom, Seesaw, Zoom, Schoology, and Freshgrade. Teachers' platform selection was determined by user-friendliness (34%), school board choice (27%), interactivity (19%), and availability of features (11%) (Decoito & Estaiteyeh, 2022). To deliver content to students, teachers relied on pre-recorded videos (19%), multimedia such as virtual labs or simulations (18%), synchronous/live teaching (15%), digital creation tools for videos or presentations (14%), and other methods (11%). Popular online resources accessed by teachers included YouTube, Khan Academy, a variety of apps and websites, and teachers' personal websites (Decoito & Estaiteyeh, 2022).

Challenges and Barriers. An already difficult situation was compounded with issues such as access to devices, internet connectivity, and teacher skills. Access to technology devices and internet connectivity were pervasive and significant barriers during remote teaching. Indonesian teachers discussed the lack of devices in homes, poor internet connectivity, and the cost/availability of internet and cellular data packages (Rasmitadila et al., 2020). Reliable internet access for teachers and students and student access to devices were recognized as the third greatest difficulty encountered by American teachers during remote learning (Francom et al., 2021). Ontario Kindergarten teachers reported many concerns with technology as they taught remotely (Spadafora et al., 2022; Timmons et al., 2021). Students and families struggled to access platforms, remember passwords, and access devices while contending with unreliable

internet; internet connectivity was an issue for educators as well (Spadafora et al., 2022).

Concerns were reported with inequitable technology access with no devices in some homes or multiple children sharing one device (Timmons et al., 2021).

Teachers' competence and confidence with technology and online pedagogy was another barrier to successful online teaching. A mixed-methods online study of 325 American Kindergarten-Grade 12 teachers assessed educators' preparedness level for and challenges encountered during remote teaching (Trust & Whalen, 2020). Survey questions generated quantitative and qualitative data which were analyzed with descriptive statistics and thematic analysis. On average, teachers reported facing 4.89 different challenges as they moved to emergency remote teaching. These challenges included: i) lack of preparedness to use online teaching strategies and tools; ii) adapting pedagogical approaches for online learning; iii) unreliable internet access; iv) changing personal needs; and v) vague or constantly changing government and school district directives. Finding, evaluating, and curating digital tools and resources as well as student communication and engagement emerged as other areas of challenge. Participants expressed that teachers required more training to teach with technology successfully, identifying self-directed learning, ongoing practice, working with mentors and coaches, and collaboration with colleagues as potentially helpful approaches (Trust & Whalen, 2020).

Teacher technology skills were identified consistently as a barrier; 59% of Ontario Kindergarten teachers stated that their own lack of proficiency with digital platforms was interfering with their ability to teach online (Spadafora et al., 2022). Setting up digital learning, sourcing and creating online materials, and monitoring and supporting online student learning were cited as issues by 36.9% of American teachers (Francom et al., 2021). To overcome these

challenges, teachers turned to YouTube tutorial videos, Google searches, trial and error, professional learning networks, and colleague support (Francom et al., 2021; Trust & Whalen, 2020). Teachers were mainly responsible for solving these new problems on their own in this strange and unprecedented time. The next section explores the mental health and well-being of teachers during the pandemic.

Teacher Mental Health. Mental health is defined as a condition of well-being in which a person feels capable, manages the regular stresses they encounter, works efficiently, and contributes to their community (World Health Organization, 2018). Teaching has been recognized as a profession that is highly rewarding yet extremely stressful (Herman et al., 2018; Sokal, Trudel, et al., 2021). Prior to the advent of COVID-19, teacher mental health was a significant concern, with teachers facing some of the highest amounts of occupational stress and lowest levels of well-being among all professions (Kush et al., 2021). When teachers struggle, so do children and school communities; the consequences of poor mental health are experienced by more than the individual teacher. Healthy, stable educators are essential to effective education; teacher mental health is a key element in strong teaching practices, student social-emotional development (Roffey, 2012), and academic achievement (Briner & Dewberry, 2007). When a teacher's mental health suffers, it is more likely that negative student behavior will occur (Hoglund et al., 2015). Working in a profession already known for its high levels of stress, what are the mental health outcomes of living and teaching through a global pandemic? The next paragraphs examine the mental health of the general population during the pandemic followed by an in-depth exploration of teacher mental health.

Mental Health and Screen Time. Since March 2020, the COVID-19 pandemic has presented one of the largest global challenges ever experienced with millions of people

becoming ill and lives turned upside down (Aknin et al., 2022). Almost without exception, the pandemic continues to have major repercussions for the physical and mental health of the entire population (Sultana et al., 2021). Aknin et al. (2022) reviewed studies investigating the mental health outcomes of the COVID-19 pandemic. This analysis of the literature revealed that anxiety, depression, and distress increased at the onset of the pandemic while suicide rates, life satisfaction, and loneliness were largely unchanged during the first year. Psychological distress was caused by exposure to or experiencing infection, financial uncertainty, watching or reading the news, and increased workloads from chores, childcare, or homeschooling.

Sultana et al. (2021) conducted a narrative literature review to investigate increased digital screen time during the pandemic as a health concern. Triggered by the need to work, learn, and connect with others online, many people were forced to cope with increasing screen time demands and the physical and mental health ramifications. Increased screen time was found to be linked to weight gain, high blood pressure, Type 2 diabetes, vision problems, depression, and insomnia; these conditions were more likely to occur in people with sedentary lifestyles and pre-existing unhealthy behaviors (Sultana et al., 2021). In addition to the above concerns experienced by the general population, teachers were required to rapidly shift the nature of their teaching practices with little to no preparation or training (Winter et al., 2021).

Mental Health of Canadian Teachers during COVID-19. Several Canadian studies provided a window into the challenges faced by educators during the pandemic. Poor mental health and increased teacher workload emerged as significant issues for teachers across the nation. In a large online survey conducted by the Canadian Teachers' Federation (2020), 14,000 teachers responded to a mental health check-in. Teachers ranked workload and work-life balance as their second-greatest concern at the start of the 2020-21 school year with stress, anxiety, and

depression ranked as their most significant concern. Close to half of respondents (46%) expressed that they were worried about their mental health and overall well-being, reporting stress, an inability to cope, and feelings of unhappiness. This alarming figure prompted a follow-up study consisting of 32 open-ended, semi-structured interviews with Canadian teachers (Canadian Teachers' Federation, 2022). An overwhelming number of participants (97%) expressed that they were struggling with increased job demands and greater physical, mental, and emotional workloads. Adding to the pressure that they were already experiencing, teachers explained that they were more concerned about students' needs than their own with 81% of participants identifying student success as a major concern.

Increased workload and a decline in mental health were also reported by teachers in British Columbia. Gadermann et al. (2021) conducted a cross-sectional, survey-based study with 1206 teacher respondents in February 2021. More than half of participants (54%) were elementary school teachers. Two-thirds of teachers indicated that their workload was more or a lot more than prior to the pandemic. BC teachers also described decreased well-being since the onset of the pandemic; 56.5% of teachers met the criteria for moderate mental distress while 22.9% experienced serious mental distress. A loss of connection was cited by many teachers. Fewer opportunities to connect with students (69.4%), parents and caregivers (77.7%), and colleagues (92.7%) emerged as a contributing factor to deteriorating teacher mental health. Despite all the negative impacts of the pandemic, support from colleagues, administration, communities, and other sources emerged as a protective factor for teachers' mental health (Gadermann et al., 2021).

The increasing demands on teachers and potential burnout was examined in a study of Manitoba teachers (Sokal, Babb, et al., 2021). Latent profile analysis was conducted on a subset

of national data to examine the psychological and organizational demands of teaching in Manitoba during the pandemic. Using a quantitative design, three surveys were conducted across Canada in April, June, and September 2020; 1019 Manitoba teachers' responses were extracted and analyzed for this particular study. A burnout model developed by Maslach and Jackson (1981) examined burnout in three dimensions: i) increased emotional exhaustion; ii) increased cynicism or depersonalization; and iii) reduced personal accomplishment. Using these three dimensions, latent profile analysis divided Manitoba teachers into five profile groups: engaged (9%), involved (17%), over-extended (27%), inefficacious (28%), and detached (18%). Compared to teachers across Canada, Manitoba teachers showed higher levels of exhaustion and depersonalization/cynicism. 46% of Manitoba teachers were classified as either inefficacious or detached whereas only 27% of Canadian teachers fell within this very concerning range. The researchers commented that most teachers appeared positive and productive in their roles despite exhaustion and constant uncertainty caused by pandemic teaching conditions (Sokal, Babb, et al., 2021).

Key issues impacting the mental health of Canadian teachers during the pandemic included workload, student needs, and loss of personal connection, resulting in mental distress, exhaustion, and burnout (Canadian Teachers' Federation, 2022; Gadermann et al., 2021; Sokal, Babb, et al., 2021; Sokal et al., 2021). An examination of international studies yielded similar findings; teachers studied in Poland, United Kingdom, United States, and Wales also reported a decline in their overall mental health (Allen et al., 2020; Baker et al., 2021; Jakubowski & Sitko-Dominik, 2021; Kush et al., 2021; Marchant et al., 2021). The pandemic and the resulting school closures have led to broad and unanticipated consequences for teacher mental health (Marchant et al., 2021). Issues and experiences such as remote teaching, increased workload, and loss of

connection have resulted in a teacher mental health crisis in Canada (Canadian Teachers' Federation, 2022) and around the globe.

Summary

In this review of the literature, several overarching themes were identified to more fully explain how and why primary teachers integrate technology. Teachers' self-efficacy, confidence, and competence, pedagogical beliefs, as well as the barriers they experience, emerged as determinants of teachers' technology use. Technology is ubiquitous and used for many purposes such as curriculum implementation, literacy and numeracy skill development, assessment, family communication, lesson planning, global collaboration, and interdisciplinary learning. However, individual teacher use varies depending on barriers such as technology skills, time, and competing priorities. A digital divide that includes access to technology and internet connectivity was identified as a significant obstacle to technology integration, especially in rural areas.

Although teacher technology use has varied greatly in the past, teachers were united in a common purpose with the pandemic and the advent of emergency remote teaching in March 2020. Following a rapid shift to online teaching, teachers relied on learning management systems, synchronous and asynchronous learning activities, and content delivery methods such as YouTube and teacher-created videos. Not surprisingly, student-centred practices, assessment, and differentiated instruction decreased in quality and frequency. Teacher mental health also suffered greatly during this difficult time.

Lastly, this review of literature revealed that there was a dearth of Canadian research that provided specific examples and detailed descriptions of teacher pedagogy and technology integration practices in primary settings. At the moment, there is also a lack of literature describing the pedagogical practices of teachers during the pandemic, although it is anticipated

that more research will be forthcoming. New research that addresses these gaps in the literature may increase authentic understandings of teachers' purposes and classroom practices.

Chapter 3: Research Methodology

In this chapter, I discuss the research design and outline the specific methods selected to investigate the topic under study. In the beginning sections, I provide an overview of mixed-methods approaches, including the blend of qualitative multiple-case study and quantitative survey, and share my rationale for the use of these methods. This is followed by an examination of my positionality as a researcher. In the second section, I describe how research sites and participants were chosen and offer a description of the participants and their school and classroom contexts. Next, I explain the quantitative and qualitative data collection and analysis procedures. Lastly, I examine the four components of trustworthiness and how I have addressed them in my research. A brief summary concludes the chapter.

The Research Design

As addressed in the first chapter, when examining technology integration in primary classrooms, there is a paucity of literature in two areas: i) technology integration in primary classrooms in Manitoba; and ii) teachers' technology integration experiences in rural communities. My study has been conducted to add to this body of research by exploring and describing Kindergarten-Grade 2 teachers' pedagogical influences and beliefs on technology integration, their attitudes and values in relation to technology, and their technology-supported teaching and learning activities.

Mixed-Methods Research Design

There has been a long-standing interest in combining methods in social sciences research, and mixed-methods approaches have enjoyed a rapid surge in popularity in recent years (Timans et al., 2019). Creswell (2015) defined mixed-methods research as:

an approach to research in the social, behavioral, and health Sciences in which the investigator gathers both quantitative (close-ended) and qualitative (open-ended) data, integrates the two and then draws interpretations based on the combined strengths of both sets of data to understand research problems. (p. 2)

In mixed-methods designs, researchers often use qualitative research methods for one stage of a study and quantitative research methods for another stage, either concurrently or sequentially (Leech & Onwuegbuzie, 2009). There are numerous approaches for blending quantitative and qualitative methods. Merriam and Tisdell (2016) discussed qualitative mixed-method case study in which the qualitative data remained primary with a nested quantitative component, such as a survey. Leech and Onwuegbuzie (2009) identified this mixed-methods design typology as a partially mixed sequential dominant status design, which they described as a study involving two stages that take place sequentially, with either the quantitative or qualitative phase more strongly emphasized. The initial use of a survey to collect quantitative data, followed by identifying a small number of potential case study participants for in-depth study, falls under this typology.

In my research, I began with a quantitative component (survey) followed by a qualitative component (multiple-case study). These components were undertaken in the following sequence: i) administration of a survey to all Kindergarten-Grade 2 teachers in two school divisions; ii) analysis of survey data using descriptive statistics (e.g., percentages, mean, median, and mode); iii) connection of quantitative and qualitative components through participant selection and use of survey data to inform the interview questions; iv) data collection in four classrooms; v) qualitative data analysis; and vi) integration of quantitative and qualitative findings. The

following sections outline the advantages and disadvantages of this type of methodology, and provides more specific details of the research design.

Considerations for Mixed-Methods Design

There is a lengthy history of case study researchers utilizing both qualitative and quantitative sources of data to deepen the understanding of the case (Stake, 1995; Yin, 2018).

Yin (2018) argued that mixed-methods case study research allows researchers to investigate more complex research questions and build more powerful evidence than are achievable by a single research method. It is possible that the deductive and inductive reasoning that are used in mixed-methods research may yield stronger results, particularly in case study research that generates rich empirical data obtained through a variety of methods (Kitchenham, 2010).

Kitchenham (2010) posited that mixed-methods case study works in an integrated fashion to fill the gaps created by both qualitative and quantitative approaches. A mixed-method design is well suited to research questions that require authentic, contextual understandings, a variety of perspectives, and cultural understandings (Creswell, 2009, 2015).

Although there are many favourable reasons to engage in mixed-methods research, it is important to also consider the disadvantages. Yin (2018) cautioned that a mixed-methods case study design is more challenging to execute than single methods studies. Prospective researchers must also consider the extensive data collection, the demands of analyzing both textual and numeric data, and the required knowledge of both quantitative and qualitative approaches (Creswell, 2009). Planning, preparation, and support from more knowledgeable scholars is key in the successful execution of a mixed-methods case study design (Merriam & Tisdell, 2016).

Rationale for a Multiple-Case Study Approach

The multiple-case study component of my research focuses on two urban classrooms and two rural classrooms in Manitoba, studied parallel, during a 10-month school year. As I am examining how and why teachers integrate technology, my unit of analysis is teacher practice. Case study methodology is particularly useful for exploring “how” and “why” questions (Yin, 2018), which are essentially the focus of my study. A case study design enabled me to deeply investigate what was happening in my home province, developing a highly detailed, thick description (Geertz, 1973) to gain a more thorough understanding of how technology is integrated in Kindergarten-Grade 2 settings.

A multiple-case study approach (Yin, 2018) is ideally suited to studying the practice of four teachers. Chmiliar (2010) described multiple-case study as case study research in which several bounded cases are chosen to produce a greater insight into a phenomenon than an individual case could produce. Multiple-case studies allow exploration within and between cases (Yin, 2018), facilitating an understanding of how single cases might be influenced by different environments as well as the conditions under which a finding might occur (Chmiliar, 2010). Yin argued that while single case studies can provide important understandings and knowledge, multiple-case studies are usually more compelling with their greater amount of description and explanation. Stake (2006) advised that the benefits of multiple-case study will be limited with fewer than four cases or more than ten. Including multiple cases and/or sites allows the researcher to illuminate the issues across a wider range of circumstances, increasing the breadth of the findings (Chmiliar, 2010). This approach is particularly advantageous in school sites where it can be difficult to differentiate between context and events (Goddard, 2010).

Bounding the Cases

Merriam and Tisdell (2016) cautioned that if the phenomenon the researcher wants to study is not intrinsically bounded, it is not a case. A clearly bound case is essential to successful case study; these boundaries indicate what will and will not be included in the research project, defining the breadth and depth of the study (Baxter & Jack, 2008). Baxter and Jack (2008) argued that bounding the case ensures that the study remains manageable in scope, whether it is bound by time and place (Creswell, 2009) or by time and activity (Stake, 1995). Although spatial and temporal boundaries apply to all case studies, researchers should also be aware of common-sense, theoretical, and methodological ways of bounding the case (Elger, 2010). When a case is bound methodologically, the thorough examination of the case is positioned within the broader external context. Identified as most fundamental to case study research (Elger, 2010), a theoretical bounding of a case study involves the application of theoretical approaches to the definition and investigation of the case.

In my examination of how and why teachers integrate technology, my multiple-case study was bounded by one school year and teachers' technology-supported practices within that year. It is important to consider how teachers view the boundaries of their own teaching practice. With pandemic teaching and learning, teachers' practices are no longer confined to the walls of the classroom or school; instead teaching activities extend into students' homes and communities. With technology-supported teaching activities transcending the traditional boundaries of schools and classrooms, theoretical bounding is important as I apply the lens of sociocultural theory (Vygotsky, 1978).

Quantitative Component

In my study, a survey was conducted to collect quantitative data prior to employing qualitative methods. A survey is defined as a data collection tool that gathers self-reported responses to a set of pre-determined questions (Tan & Siegel, 2018). Survey questions were drawn from quantitative surveys that I had examined in the literature and based on my knowledge and experience of technology integration in Manitoba classrooms. The 13-item survey was sent by email to all Kindergarten-Grade 2 teachers in the rural and urban school divisions. It began with obtaining consent from each respondent with a yes/no question followed by three demographic questions (school location, grades taught, years of teaching experience). The remaining items queried teacher confidence, technology skills, frequency of tool and device use, purposes for integrating technology, value of technology integration, main reasons for using technology, and barriers to technology integration. An open-ended question encouraged teachers to share any other information about how and why they used technology in their classrooms. The final item recruited teachers who integrated technology on a regular basis to participate in my multiple-case study. View the survey online [here](#).

Although it is a popular quantitative method, there are strengths and weaknesses to survey research. When open-ended questions are included, surveys may provide access to participants' thoughts more clearly than other methods. As many participants may respond to survey questions over a short period of time, a large number of responses can be collected quickly and inexpensively. Additionally, aggregating and summarizing data statistically is simplified when all participants have answered the same set of questions (Tan & Siegel, 2018). However, researchers must be aware that not all participants may be able to recall their experiences and report their thoughts accurately; instead they may rely on reasonable theories or

what they believe is socially acceptable (Nisbett & Wilson, 1977). Other disadvantages of surveys include a lack of flexibility in the pre-determined questions and difficulty in developing questions that draw out accurate answers.

Some of these disadvantages may be negated when surveys are part of a mixed-methods study. The strengths of surveys (cost-effective, quick, large number of respondents) can be enhanced with the addition of rich data generated qualitatively through tools such as observation and interviews (Tan & Siegel, 2018). By adding qualitative components, researchers may be able to use survey results as a guide to determine where they might probe more deeply, assisting them in the development of interview questions.

In summary, this dissertation study used a mixed-methods multiple-case study design that includes a quantitative component (a survey) as well as a more primary qualitative component (participant interviews, student work samples, teacher social media posts). Whereas the survey was designed for all teachers in the participating school divisions to respond, the multiple-case study focused on four teachers' classroom practices as described in participant interviews and illustrated in student work samples and teacher social media posts. Each teacher comprises one case that is bounded by their technology-supported teaching and learning activities over a school year. By implementing this research design, I aimed to gain a broad understanding of rural and urban teachers' technology integration practices followed by an in-depth examination of two urban and two rural primary teachers' classroom practices. In the next section, I discuss my positionality as a researcher.

Researcher Positionality

According to (Holmes, 2020), researcher positionality is based on the location of the researcher in regard to the topic under investigation, the research participants, and the research

context and process. In terms of the focus of investigation, it was important for me to acknowledge that as a practicing primary teacher, I hold definite opinions about technology integration. In my own classroom practice, I always strived to integrate technology in ways that enhanced teaching and learning, rather than as a substitute for traditional methods. As I engaged with participants, I was conscious of my own tendency to evaluate their classroom practice as they shared it with me. Being aware of this tendency and documenting it in my reflexive journal was an important step for me; I also realized that being aware of my own biases and documenting them did not prevent them from influencing my research (Holmes, 2020).

When considering positionality in research, the perception of the researcher as an insider or an outsider by the participants is a valuable consideration (Bengry, 2018). As a practicing primary teacher, I regarded my perspective as emic, and I believe that my research participants also related to me similarly as a colleague and fellow educator. Although I felt that this led to a strong rapport and honest conversations, Ryan et al. (2011) cautioned that this insider status may result in participants self-censoring as they fear that they are being judged by a peer. In addition to being a primary teacher, I have also presented at conferences across the province and I am a podcast host. Three of my four case study participants knew of me before becoming involved in my research, and I was concerned that they would feel the need to say what they thought I wanted to hear. Since I was aware of this, I strived to put my research participants at ease and explained that I was genuinely curious about how they were using technology in their classroom practices. For example, when asking participants about a time when technology integration was a failure, I began by sharing a challenge that I had experienced in the past.

I was very grateful that these four teachers volunteered to participate in my study during such a difficult time in educational history, and I wanted to ensure that this was a beneficial

experience for them as well. If one of my participants talked about a technology tool, pedagogical approach, or resource that I had additional information on, I would often forward it to them after our interview. I believe that this reciprocal sharing of ideas built trust and added value to their experience without compromising the data collection. The following section provides more information on research sites and teacher participant selection as well as the research contexts.

The Research Contexts and Participants

Selection of School Divisions

My research was designed with the intent of examining teachers' technology-supported practices in rural and urban Manitoba settings. Therefore, it was necessary to select one rural school division and one urban school division for my study. As the nearest city of Brandon, Manitoba, is classified as a medium population centre (population of 48,859) rather than a large urban population centre (Statistics Canada, 2016c), a school division in the capital city of Winnipeg best met my criteria for an urban setting. After receiving approval from the University of Victoria's Human Research Ethics Board (see Appendix B), I began to contact potential research sites. Obtaining permission to collect data during the height of the pandemic was a challenging undertaking. Letters were sent to superintendents in rural and urban school divisions (see Appendix C). Most of the time, my requests did not receive a response, and when I did receive a reply, it was a negative one. Finally, I received affirmative responses from Seven Oaks School Division in the northwest area of Winnipeg and Park West School Division in rural southwestern Manitoba. The next task was to distribute my survey and recruit teacher participants for my study.

Selection of the Teachers

It is vital that individual cases for inclusion in a multiple-case study are deliberately chosen to foster a greater understanding of the issue (Chmiliar, 2010). Since I was studying teacher's technology-integrated practice and pedagogy, it was imperative that the participants I selected taught Kindergarten-Grade 2 and integrated technology on a regular basis. The quantitative survey sent to all Kindergarten-Grade 2 teachers in the participating school divisions was used as a teacher recruitment tool. At the end of the survey, I invited teachers who regularly integrated technology to consider participating in my multiple-case study. As I sought regular users of technology, this could be described as purposive sampling (Patton, 2002). Purposive sampling was necessary as my research questions required teachers with specific characteristics (Johnson & Christensen, 2008). If the research participants did not integrate technology regularly, my ability to generate rich descriptions of technology-supported teacher practice would be compromised.

However, in the fall of 2020, it was very difficult to obtain survey responses from teachers in both rural and urban school divisions. As a practicing teacher myself at the time, I attributed this to the overwhelming nature of teaching during a pandemic. To increase survey responses, I contacted school principals and Park West School Division's instructional technology coach via email asking them to encourage their teachers to complete the survey. I sent these emails a day prior to in-school professional learning and administration days anticipating that teachers and principals might have more time with no children in their buildings. I also asked principals and the unit leader of Manitoba Education's Early Childhood department if they had any suggestions for case study participants in Seven Oaks and Park West

School Divisions. Similar to obtaining approval from school divisions to conduct research, recruiting teacher participants was a challenging and slow process. Several teachers volunteered but admitted they used technology infrequently. Finally, after recruiting three teacher participants, a fourth teacher who met the criteria volunteered to participate in the multiple-case study in December 2020.

The anonymity of participants and the use of pseudonyms was an important consideration, especially in small rural areas where participants were more easily identifiable. I gave all participants the option to waive anonymity on their consent forms; however, I understood that I would need to decide if one person waiving anonymity would compromise the identity of others in the group (Canadian Institutes of Health Research et al., 2018). In my study, all participants signed the teacher consent forms (see Appendix D) and waived anonymity. I provided teachers with letters to send home informing their students' families about their participation in my research (see Appendix E). In the next section, I provide more information about the rural and urban school divisions and individual schools of the research participants. The section concludes with a discussion of the provincial technology context and the pandemic teaching conditions that prevailed during data collection.

The Research Context

Rural School Division: Park West School Division. This sprawling school division in southwestern Manitoba covers a large geographical area, stretching from the northernmost point of Inglis, Manitoba, to the southernmost point of Kenton, Manitoba. The division is comprised of six elementary schools, four secondary schools, two Kindergarten-Grade 12 schools, two Hutterian colony schools, and one First Nations school.

The division reported an enrolment of 1744 Kindergarten-Grade 12 students and employs 151 teachers (Manitoba Education, 2020c). Of the 1744 students, 27% of students have completed an Indigenous Identity Declaration, 4% of students are newcomers/English as an Additional Language, and 2% are children in care. Although distances are great in the school division, there is a 0.75 instructional technology coach who travels from school to school, mentoring individual teachers and leading professional learning activities related to technology integration. They have invested in fibre optic Internet for all schools in the geographical region which results in fast and reliable service.

Rural Research Site: Binscarth School. Binscarth School is a small rural school with an enrolment of 59 students and eight teachers (Manitoba Education, 2020a). Of these 59 students, 17% have completed an Indigenous Identity Declaration; no students are in care or classified as newcomers/English as an Additional Language (B. Matheson, Superintendent's Office, personal communication, August 2, 2022). The teaching staff is stable with relatively little turnover; new teachers are generally hired for parental leaves and retirements. As a result, the staff is comprised mainly of experienced teachers with only two early career teachers. The school's classrooms are multi-age; however, these configurations are based more on enrolment than a multi-age philosophy. Although operated separately, childcare and pre-school are available in the school building. The school offers a weekly universal breakfast program funded by provincial and national grants and a subsidized lunch program that is available several times per week.

The village of Binscarth has a population of 407 people, and is situated along the Yellowhead Highway, a short distance from the Saskatchewan border (Statistics Canada, 2016a). Located in the Rural Municipality of Russell-Binscarth, the school and community draw from a larger rural area of 2442 people (*Russell – Binscarth MB - Municipality Canada*, n.d.) as well as

Gambler First Nation, an Ojibway First Nations community. The village of Binscarth is culturally and linguistically homogenous with all residents speaking English and 15 people speaking English and French (Statistics Canada, 2016a). Agriculture, including grain and livestock farming, a small business community, and potash mining in nearby Saskatchewan are the major economic activities in the area. There is some transiency in the community, with a few families moving in and out each year and a consistent core of stable families that have lived in the community for years. A love of sports and strong community spirit characterize Binscarth, Manitoba.

Rural Research Site: Shoal Lake School. Located in the town of Shoal Lake, Manitoba, Shoal Lake School is a Kindergarten-Grade 12 school with an enrolment of 149 students and 17 teachers (Manitoba Education, 2020a). None of the students have completed an Indigenous Identity Declaration, 9% of students qualify as newcomers/English as an Additional Language, and 6% of students are in care (B. Matheson, Superintendent's Office, personal communication, August 2, 2022). The teaching staff is stable with very little turnover; new teachers are hired only in the event of parental leaves or retirements. The teaching staff is comprised of experienced teachers with only two early career teachers. Multi-age configurations are common in classrooms, although Kindergarten-Grade 4 students are in single grades for literacy and numeracy instruction. The school provides a daily universal nutritious snack program.

The town of Shoal Lake is home to 701 people and is positioned at the junction of three major highways—Highways 21, 16, and 42 (Statistics Canada, 2016b). It draws from a larger rural area of nearly 2000 people in the Rural Municipality of Yellowhead, and economic activities include agriculture (grain and livestock), tourism, and a small business community (*RM*

of *Yellowhead - Community Profile*, n.d.). Similar to Binscarth, the entire population speaks English with 15 people speaking both English and French (Statistics Canada, 2016b).

Urban School Division: Seven Oaks School Division. Seven Oaks School Division is the second-smallest urban division in Winnipeg with a division enrolment of 11,473 students, employing 837 teachers (Manitoba Education, 2020a). Located in the northwest region of Winnipeg, Seven Oaks consists of 25 schools in total, with 20 elementary schools and five secondary schools. Of these schools, 23 offer English programs and seven provide French immersion programs. There are also three schools that offer international language programs (Ukrainian, Filipino, and Punjabi) and one Indigenous language (Ojibway) bilingual school.

Seven Oaks offers innovative high school learning opportunities with three [Met schools](#). These Met schools combine high-level academic work with real-world learning experiences, career exploration, and inquiry-based learning projects (Seven Oaks School Division, n.d.-b). As an urban school division that serves a large newcomer population, this division provides migrant settlement services and a variety of programs to support language acquisition and career development (*Seven Oaks School Division*, n.d.-a). A technology statement on their website reveals a clear purpose for the use of technology and a division commitment to developing independent, lifelong learners who are critical and creative thinkers (*Seven Oaks School Division*, n.d.-a). Unlike Park West School Division, Seven Oaks does not employ a technology teacher leader or technology coach.

Urban Research Site: *École Constable Finney School*. Situated in a residential neighbourhood in northwest Winnipeg, Constable Finney is dual-track English/French immersion school for children in Kindergarten-Grade 5. With an enrolment of 455 students (Manitoba Education, 2020a), the school employs a teaching staff of 33. A conversation with

school principal (K. Hiscott, personal communication, June 24, 2022) provided additional information about Constable Finney, its population, and its programs. The principal stated that the school follows a multi-age philosophy of two grades per classroom (with the exception of Kindergarten) and there are an average of five classrooms at each level. The staff is a combination of new and experienced teachers with very little turnover.

The neighbourhood has a significant newcomer population with many cultures and languages. The school division places a strong emphasis on equity, diversity, and inclusion, including employing a diverse staff. The majority of migrant families that attend Constable Finney are from the Punjab area of India and The Philippines. Many children speak Punjabi or Tagalog/Filipino, and also speak English. Many school families have lower-mid socio-economic backgrounds with parents working outside the home. Although many of the community's newcomer families are highly skilled in their fields, their credentials have not translated to the Canadian setting.

The Provincial Technology Context. Technology has been recognized as an important priority in Manitoba for over 20 years. In 1998, Manitoba Education (1998) emphasized technology integration with the goal of enabling all students to learn to the best of their abilities, solve problems, and develop thinking skills to become productive members of society and lifelong learners. In 2002, a team consisting of Manitoba Education consultants and 16 educators was assembled to develop a Kindergarten-Grade 8 Literacy with ICT continuum focusing on inquiry, constructivist learning, critical and creative thinking, deep understanding, gradual release of responsibility, digital citizenship, and multiple literacies (Manitoba Education and Training, 2016). In 2005, Manitoba school divisions formed action research teams to pilot this continuum across subject areas with its related learning experiences and assessments. Wide-

scale Kindergarten-Grade 8 implementation occurred in 2007, followed by a refresh of the document and an expansion to Grades 9-12 in 2016.

[Literacy with ICT Across the Curriculum](#) (Manitoba Education and Training, 2016) is the current document that guides teachers' efforts to use technology. It is a continuum which overlays all subject areas, directing a continuous learning process that includes questioning and planning, gathering information and making sense, producing to show understanding, communicating, and reflecting. Health, safety, and ethical and responsible use guidelines are integrated throughout the document. Although teacher adoption of the Literacy with ICT continuum (Manitoba Education and Training, 2016) is mandated in Kindergarten-Grade 12 classrooms across the province, teachers' accounts of classroom practice suggested that teachers' beliefs, purposes, and practices are varied (Nantais & Redekopp, 2016).

The COVID-19 Pandemic Teaching Context. When Manitoba schools dismissed their students on Friday, March 20, 2020, it would be the last time they would gather as an in-person learning community that school year (*A Manitoba Coronavirus Timeline*, 2020). COVID-19 had arrived, and that same day marked the declaration of a state of emergency in the province of Manitoba and the beginning of many closures and restrictions. Schools were closed and teachers were directed to use a combination of take-home materials and online instruction to prioritize literacy and numeracy and sustain learning (Manitoba Education, 2020b). A minimum of five hours per week of curriculum-focused learning was required for students in Kindergarten-Grade 4 (Manitoba Education, 2020b). In addition, teachers were expected to monitor and assess student progress and maintain regular contact with parents, caregivers, and students through online platforms, telephone, email, or mail.

The Shift to Emergency Remote Teaching. These provincial announcements forced an immediate shift in teacher practice and a large-scale implementation of online emergency remote teaching. For many years, researchers had reported that teachers were poorly equipped to teach with technology (Foulger et al., 2017). Remote teaching required a rapid adoption of online learning platforms that many teachers were unfamiliar with (Nantais et al., 2021), revealing a considerable variation in teachers' abilities to use technology to teach learners remotely. As mentioned in the previous section, teachers experience many barriers in their attempts to integrate technology (e.g., Ertmer, 1999; Ertmer et al., 2012; Francom, 2016, 2020). The demands of remote teaching exacerbated these barriers; Internet connectivity issues, access to devices, and availability of training and technical support became acute challenges in this rapid transition (Kotak et al., 2021; Nantais et al., 2021). In the face of these obstacles and guided by what was available in their school divisions, teachers made use of platforms such as Microsoft Teams, Google Classroom, Zoom, and Seesaw to offer synchronous and asynchronous learning activities (Nantais et al., 2021).

Pandemic Life in Manitoba Schools. A pandemic response system and planning guide was developed to manage the return to school in fall 2020 (Government of Manitoba, 2021a). In primary classrooms, in-person learning occurred most of the time, with the following restrictions in place: i) two metres of physical distancing whenever possible; ii) a separated cohort system for Kindergarten-Grade 6 students; iii) limited use of shared toys, manipulatives, and devices; iv) non-medical masks worn at all times for Kindergarten-Grade 12 students and staff; and v) frequent cleaning and sanitizing of surfaces and shared items.

Shifts to remote learning were an ever-present possibility and occurred from time to time. As a precautionary measure, province-wide remote learning was scheduled the week after

Christmas break in January 2022 (Thompson, 2022). Due to increasing transmission of COVID-19, all schools in Brandon and Winnipeg transitioned to emergency remote learning on May 12, 2021, and learned remotely until the end of the school year (Government of Manitoba, 2021b). However, in both cases, the government made provision for the Kindergarten-Grade 6 children of critical service workers and Kindergarten-Grade 12 high-risk learners and students with special needs to attend school (Government of Manitoba, 2021b). Teachers were forced to teach a varying number of children in their classrooms as they taught children remotely in what has been described as a hybrid teaching and learning model (Barron et al., 2021).

During the time of this dissertation study, COVID-19 turned teaching, learning, and daily life upside down. All four research participants navigated varying pandemic teaching conditions during data collection.

The Research Participants

Four Kindergarten-Grade 2 teachers, including two from rural settings and two from urban settings, were recruited through my survey and volunteered to participate in the multiple-case study. In the following paragraphs, I provide more information about the participants, their teaching assignments, and their classrooms. These descriptions have been confirmed by the participants as accurate and representative.

Teacher #1, Rural. Danielle is a Kindergarten and Grade 1 teacher at Binscarth School in Park West School Division. At the time of data collection, Danielle's classroom enrolment included 10 Kindergarten students and seven Grade 1 students. Kindergarten students attend full alternate days until February, then attend full-time from February to June in an innovative 0.75 division-wide Kindergarten model. Danielle expressed that she was interested in participating in my study to learn more about the research process and to share her classroom practice.

Danielle lives on a farm near Binscarth in the small French-speaking community of St. Lazare. At the time of data collection, Danielle was in her seventh year of teaching Kindergarten and Grade 1 at Binscarth School, although she had been teaching for 10 years in total. In her other teaching assignments, she taught high school students, Kindergarten, and was an elementary music teacher. She completed a concurrent education and music degree program at Brandon University with the original goal of becoming an elementary school music teacher. However, full-time music positions are scarce in rural areas, so she adjusted her career aspirations to become a primary classroom teacher.

Teacher #2, Rural. Heidi teaches in a Grade 2 classroom at Shoal Lake School in Park West School Division. She also lives in the community of Shoal Lake. In 2000, she completed her Bachelor of Education degree at Brandon University. Heidi's father was an educator; this influenced her to become a teacher as well. Heidi has varied teaching experiences, beginning her career in Pine Creek School Division followed by a term position in Norway House, Manitoba (a fly-in First Nations community in northern Manitoba). In Park West School Division, she has worked almost exclusively in Kindergarten-Grade 4 settings in multiple schools.

At the time of data collection, Heidi's Grade 2 classroom enrolment was 11 students. As is often the case in small schools, grade combinations are fluid depending on subject area. For example, her Grade 2 students are combined with Grade 1 for basic French instruction, which she leads. Her students are taught health by a different teacher, and during that time, she teaches Grades 3 and 4 basic French. Heidi shared that she completed my survey and agreed to take part in the case study at the suggestion of the technology integration coach.

Teacher #3, Urban. During the time of data collection, Arielle taught 22 children in a French Immersion Grades 1 and 2 classroom at Constable Finney School in Seven Oaks School

Division in Winnipeg. There is considerable diversity among her students with many students' families immigrating from India and The Philippines.

Arielle was influenced to become a teacher by her grandmother (a Grade 1 teacher) and by her experiences working as a French language support worker. She graduated with a five-year undergraduate degree from the University of Victoria. Recently, she completed a post-baccalaureate program at the University of Manitoba. She is bilingual as she was educated in a Francophone school division and graduated from a dual-track high school program. Arielle taught Kindergarten for three years, then transitioned to Grades 1 and 2, where she has been teaching for five years.

Teacher #4, Urban. Geneviève teaches 14 children in a French Immersion Grades 1 and 2 program at Constable Finney School in Seven Oaks School Division. She is an experienced educator who has taught Grades 1-4 in the Winnipeg School Division and her current placement. She has also worked in a specialized position as a support for innovative teaching for educators in Kindergarten-Grade 6. Geneviève was encouraged to participate in this research by her colleague, Arielle.

Geneviève initially completed a French honours degree and then moved to France to work as an English-language teaching assistant. Upon her return from France, she enrolled in a teacher education after-degree program to become a teacher. Geneviève also completed a Master of Education degree in Social Foundations in the fall of 2017. Other than taking two parental leaves, Geneviève has taught for 14 years.

Expanded descriptions of these four teachers, including their beliefs about technology, their personal use of technology, and their current technology-supported teaching activities, will be discussed in Chapter 4.

Data Collection Methods

Quantitative Data Collection: Survey

For this study, a thirteen-item web-based questionnaire was developed using Microsoft Forms, containing questions as outlined in Appendix A (view online [here](#)). I chose Microsoft Forms as a tool that met ethical requirements and all data gathered by the survey were stored in Canadian servers. I chose to create and administer an online survey for ease of access and completion for participants. Given the current pandemic atmosphere as well as a desire to conserve natural resources such as paper, an online survey seemed the best choice.

The purpose of the quantitative survey was twofold: i) to provide a broad overview of Kindergarten-Grade 2 teachers' technology integration attitudes and practices; and ii) to recruit teachers to participate in my study. The survey began with obtaining consent followed by three demographic questions (school location, grades taught, years of teaching experience). The remaining items investigated teacher confidence, technology skills, frequency of tool and device use, purposes for integrating technology, value of technology integration, main reasons for using technology, and barriers to technology integration. An open-ended question encouraged teachers to share any other information about how and why they used technology in their classrooms.

The online survey, distributed by school personnel, was delivered by email to all Kindergarten-Grade 2 teachers in Seven Oaks and Park West School Divisions on October 1, 2020. To fulfill its function as a recruitment tool, survey participants were invited to provide their contact information if they were interested in participating in my study. Securing responses as well as case study participants was difficult; I attributed this to pandemic teaching and learning conditions and the mental health of teachers as described in Chapter 2. As previously mentioned, I reached out to school principals and Park West School Division's technology

integration coach to remind their teachers about the survey. I also asked the school divisions to resend the survey so that it was easily located in teachers' email inboxes.

Responses trickled in slowly, and as I still had not secured all my case study participants, the survey remained open until Christmas break in December 2020. I closed the survey when the fourth teacher agreed to participate in my study. The survey received a total of 28 responses and fulfilled its function as a teacher recruitment tool.

Qualitative Data Collection

Using a variety of data sources such as interviews, a reflexive journal, teachers' social media posts, and children's work samples facilitated the exploration of young children's technology use through multiple viewpoints, enabling different facets of the topic to be uncovered and comprehended (Baxter & Jack, 2008). As previously mentioned, I identified these methods as appropriate for studying teachers' practices. These methods also supported my theoretical frameworks of sociocultural theory (Vygotsky, 1978) and multiliteracies (New London Group, 1996). An important benefit of applying sociocultural theory to research design is the opportunity for the researcher to co-construct data with participants through dialogue and interactions (Wang et al., 2013). As detailed later in this section, some of my data were generated through conversations and semi-structured interviews with teachers to gain insight into their experiences, opinions, and viewpoints (Carl & Ravitch, 2018) on technology integration. From a sociocultural perspective, these language-based interactions were instrumental in developing a shared understanding (Mercer & Howe, 2012) between the teacher and interviewer. Interviews enabled participants to share their stories in their own ways based on what they deemed most valuable. Unfortunately, actual observations of teacher practice were not possible due to the pandemic as outsiders were not allowed in school buildings. However, viewing student work

samples as teachers explained the learning provided an opportunity to develop an understanding of the children's multiple experiences in the classroom. Examining teachers' social media posts on Twitter, Facebook, and Instagram corroborated what teachers had described in interviews and provided insight into how they used these platforms. Finally, by keeping a reflexive journal of my actions, thoughts, and reflections during the research process, I was able to document the research process as it unfolded, decide which lines of inquiry to pursue with each teacher, and monitor my own assumptions and biases as a researcher.

Semi-Structured Interviews. According to Stake (1995), the two most important functions of a case study are to obtain the descriptions and interpretations of participants, and “the interview is the main road to multiple realities” (p. 64). Interviews as a data collection method enabled teachers to share their beliefs about technology and relate how it was integrated in their classrooms. As a result of the pandemic situation, I completed 5-6 interviews with each research participant via video conferencing from January-June 2021. It was through interviews that I connected the quantitative and qualitative stages of my research design. As a researcher, I made decisions as to what quantitative results required further exploration through qualitative data collection, and semi-structured interviews enabled me to delve more deeply into topics and questions raised in the survey.

Interviews were conducted using Microsoft Teams; this was an ethical requirement to ensure that all data were stored on Canadian servers. Not surprisingly, the rural teacher participants and I sometimes experienced poor Internet connectivity which impacted the interview experience, impairing both audio and video from time to time. However, engaging in the member-check process (Lincoln & Guba, 1985) of my transcripts ensured accuracy.

Interviews ranged in length from 35-60 minutes and verbal consent was obtained from each teacher at the beginning of every interview. The following lines of inquiry were pursued with the four research participants: i) demographics and classroom/school context; ii) educational history and reason for entering the teacher profession; iii) beliefs about teaching and learning; iv) beliefs about technology integration and advantages/disadvantages; v) technology use in their personal lives; vi) classroom access to technology and barriers experienced; vii) technology tools and how/why they are integrated; and viii) pandemic teaching with technology.

Depending on the technology available to teachers and their unique situations, attitudes, and beliefs, other interview topics were introduced, including inquiry/project-based learning and technology, story workshop and technology, coding, family communication, and technology and French language instruction. At times, interview questions were more structured to obtain specific information; other times questions were more open-ended to generate descriptive data and stories. These less-structured questions acknowledged that each participant viewed the world in a different way (Merriam & Tisdell, 2016) and provided opportunities for them to share what they regarded as important and relevant. During interviews, I often paraphrased what the participant shared and asked for confirmation that my understanding was accurate. Participants were advised of the interview topics and questions in advance via email and were given the opportunity to suggest topics for future interviews.

Transcription. Since I was investigating technology integration, it made sense to me to take advantage of the many affordances offered by technology to enhance and support the research process. For example, to make scheduling as convenient as possible, participants booked their own monthly interview times using an online scheduling tool that was linked to my Microsoft Outlook calendar and Teams account. Transcription was an area in which I maximized

the capabilities of Microsoft 365 tools. Interviews were recorded in Microsoft Teams with auto-generated captions. These auto-generated captions of the conversation were then converted and extracted into a Microsoft Word document. Unfortunately, initial transcripts were not perfect; I replayed the interview at a reduced speed while checking and editing the transcripts (see Table 1 for conventions used). Although this was a time-consuming process, it gave me the opportunity to engage deeply with the data, consider ideas for future codes and themes, and determine which lines of inquiry I wanted to pursue next. Identifying themes in qualitative data starts with the process of transcription (Bogdan & Biklen, 1982; Braun & Clarke, 2006, 2022); at least two readings of each transcript are recommended. After each transcript was completed, I emailed it to the research participant to review it for accuracy and make any necessary changes. All participants returned the transcripts with few changes and these transcripts were used in the analysis.

Table 1

Transcription Conventions

Convention	Meaning
(Clarification)	Additional information added in parentheses to clarify
...	Dots to indicate a short pause
(pause)	Indicates a long pause
(laughter)	Indicates laughter in the conversation

Student Work Samples. In this study, student work samples provided significant insight into individual teacher cases. This supports Merriam's (1998) position that documents may include written, visual, and physical materials that can illuminate the case under study. Originally, I planned to visit research sites monthly, meet the children, and view technology-created student work as it was produced within the classroom setting. However, as previously

stated, pandemic teaching and learning conditions prevented outside personnel from entering school buildings. As a result, I made time in our monthly interviews for teachers to share student work samples with me. I asked teachers to share how the student work was created (what tools were used), the learning experience surrounding the student work (how the lesson was taught, what curricular outcomes were addressed, why the work was created), and their reflections on the process. Viewing and discussing samples of student work provided information about teachers' purposes for integrating technology as well as the tools they used in their classrooms. It also allowed me to gain insight into the match between their description of their classroom practice and their actual classroom practice. As teachers discussed the student work, I continued to record, and then transcribe, the interview.

In accordance with ethics and the letters sent home to children's families, all student work samples that I viewed were anonymized and the teacher refrained from using student names. If a student's name was used accidentally, it was deleted from the transcript. Viewing student work samples was a powerful form of data collection; it gave me an opportunity to determine if teachers' beliefs and descriptions of classroom practice were aligned with actual learning experiences and the products created by students.

Teachers' Social Media Posts. Two of the teachers studied, Heidi and Genevieve, used social media platforms to support, document, and share their technology-supported teaching activities. As permission to view social media posts had been obtained at the beginning of the study, I examined both teachers' public posts on Twitter, Facebook, and Instagram. The social media activities of the teachers provided additional context for the vignettes that I developed and corroborated the classroom technology integration practices that I had been unable to observe in person.

Reflexive Journal. My interviews with participants and viewing of student work samples were augmented with a reflexive journal. Known as self-reflective, reflexive, or reflective journals, keeping a journal throughout the research process is a strategy that enhances reflexivity (Russell & Kelly, 2002). Reflexive journals assist researchers in examining their personal assumptions and goals while shedding light on their belief systems and biases (Russell & Kelly, 2002). Lincoln and Guba (1982) suggested that reflexive journals include the following components: i) evolving perceptions; ii) day-to-day procedures; iii) methodological decision points; and iv) personal introspections.

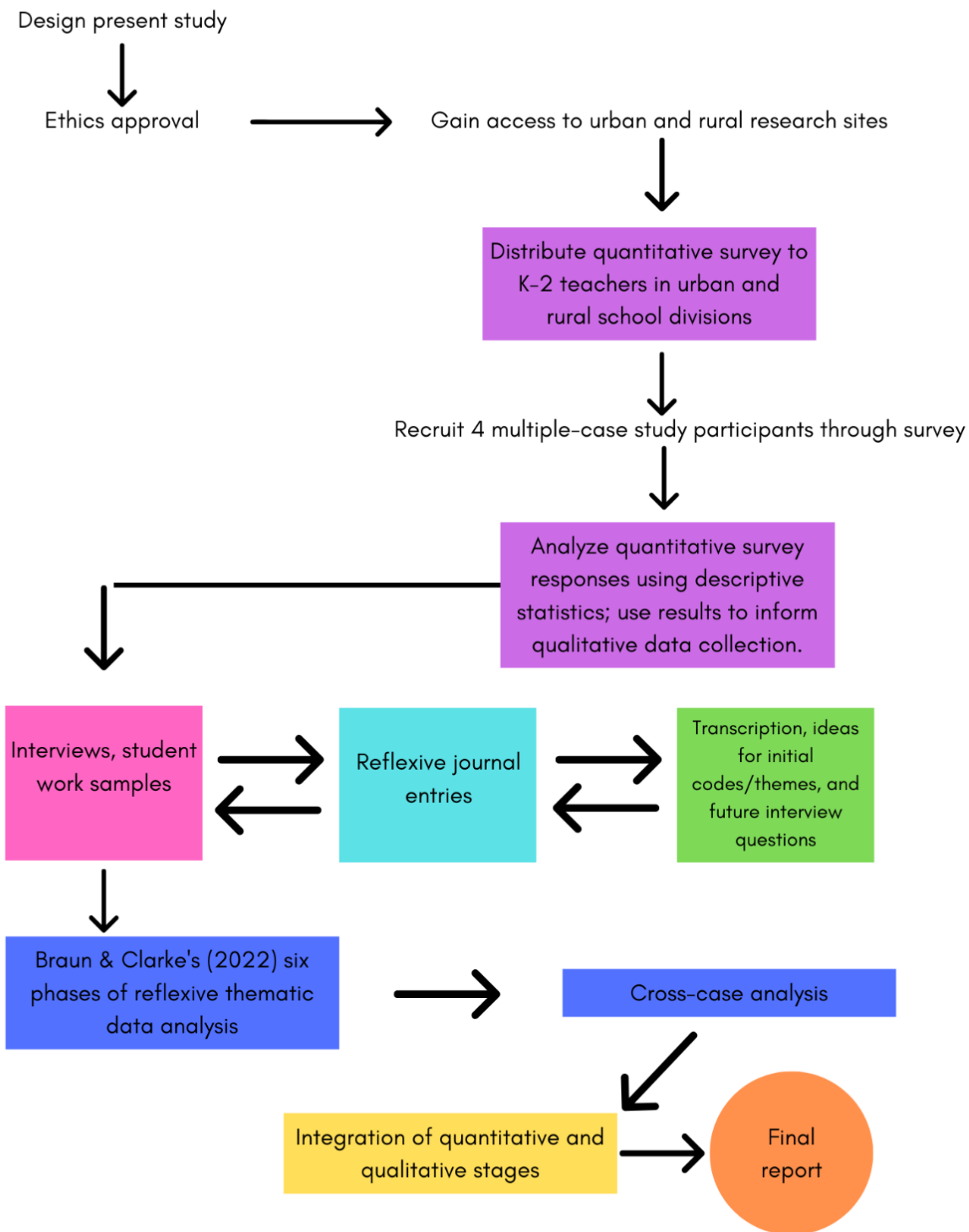
Writing in the first person, I maintained my reflexive journal throughout the research process, documenting the process and my thoughts ranging from site selection to my final interview. I regarded my reflexive journal as a form of field notes and a rich primary data source. I wrote entries immediately following each interview; this proved indispensable during transcription and initial data analysis. Following the recommendations of Rau et al. (2018), I included information such as my own experience of the interview, documentation of contextual factors (such as emotions, participant exhaustion, noise, or distractions), and my own intuition about what was shared. Additionally, I listed ideas for initial codes and themes and made notes about questions or lines of inquiry to pursue in subsequent interviews. Maintaining a reflexive journal helped me to map my research process and monitor my own positionality and biases to achieve a rigorous research process and enhance the trustworthiness of the study (Lincoln & Guba, 1982).

In keeping with my desire to use the affordances of technology to support the research process, I used [Microsoft OneNote](#) for my reflexive journal. I began by creating a OneNote notebook (a digital binder) for my entire research process. For the reflexive journal, I made a

section with a page for each teacher participant. After each interview, I began with the current date and wrote my entry. There were many advantages to using Microsoft OneNote: i) data is stored on Canadian servers; ii) OneNote notebooks can be password-protected for additional security; iii) OneNote is cross-platform, meaning that I could access my reflexive journal from multiple devices and platforms as needed; and iv) I could include photographs, work samples, audio recordings/voice notes, and files. Microsoft OneNote was a highly effective and efficient solution for documenting my research process. In the next section, I address quantitative and qualitative data analysis.

Data Analysis

The following section discusses the data analysis procedures I used in this study. In this research, data analysis consisted of descriptive statistics as well as reflexive thematic analysis (Braun & Clarke, 2022). I concluded the data analysis by engaging in a cross-case analysis that integrated the quantitative data. The following diagram (see Figure 1) provides a visual representation of data analysis and highlights the recursive nature of the qualitative data collection and design.

Figure 1*The Research Process*

Quantitative Data Analysis

Following the closure of the survey in December 2020, survey data were analyzed using simple descriptive statistics to organize, describe, and summarize the information gathered (Coleman, 2018; Creswell, 2012). These descriptive statistics included percentages, mean, median, and mode. Descriptive statistics are useful in communicating information effectively and reducing the loss of important evidence by representing it with numerical values and graphs (Coleman, 2018). Measures of central tendency (such as mean, median, and mode) were employed to determine the average data value. Descriptive statistics were also used to share the distribution of the responses to questions. The survey was administered using Microsoft Forms, and intelligence-based data insights were customizable and charts were auto-generated.

I was interested in determining if rural and urban teachers differed on some responses; however, this required more in-depth statistical analysis. In consultation with a statistician, it was decided that a Shapiro-Wilk test and a Mann-Whitney-Wilcoxon test would be useful measures to employ. The Shapiro-Wilk test is used to determine if a variable is normally distributed in a population (Statistical Package for Social Sciences, n.d.). The Mann-Whitney-Wilcoxon Test (also known as Wilcoxon Rank Sum Test) is a non-parametric form of the two-sample t-test used when assumptions are not met. This test determines if the two populations appear to be the same based on the ranks of the values. These statistical tests were used on Questions 5 and 6 to examine confidence levels and feelings of self-efficacy when integrating technology among rural and urban teachers. Question 5 asked respondents to use a scale of 1-5 where 1 meant not at all confident and 5 meant extremely confident to share how confident they felt when integrating technology in their classroom. Question 6 requested respondents to use a scale of 1-5 where 1 meant beginner and 5 meant expert to rate their ability to successfully integrate technology in

their teaching. RStudio, free and open-source software for data manipulation, calculation, and graphical display, was used to perform these tests and develop graphs (*Introduction to R and RStudio*, n.d.). For all quantitative items, results were shared using a combination of charts and graphs as well as narrative form.

There was one open-ended response question on the survey in which teachers were asked to share additional information about how and why they used technology in their classroom. These responses were exported to a spreadsheet, one response per row, and coded.

Qualitative Data Analysis: Reflexive Thematic Analysis

Described as an accessible and robust method for data analysis, reflexive thematic analysis (Braun & Clarke, 2006, 2019, 2020, 2022) is well-recognized, highly cited, widely used, and continually evolving. Although numerous forms of thematic analysis exist, Braun and Clarke differentiate their method from others; one way they did this was by changing the name to reflexive thematic analysis in 2019 (Braun & Clarke, 2019). In a [recorded webinar](#) available on YouTube, Clarke (2021) explained that other approaches to qualitative data analysis could be very prescribed and rigid where certain activities and steps must be followed. In comparison, reflexive thematic analysis is very customizable in that it is: i) uniquely flexible; ii) not tied to a particular theoretical framework; and iii) the researcher must decide how to conduct their own data analysis and develop a rationale to explain those methodological choices.

This flexibility appealed to me as case study is a flexible and evolving methodology (Yin, 2018), and it made sense to choose a method of data analysis that also allowed for the methodological choices of the researcher. Although many choices are left to the discretion of the researcher, since their form of thematic analysis was first published in 2006, Braun and Clarke

(2006) recommended adherence to six phases of data analysis. Despite the evolution of these six phases over the past 16 years, many aspects have remained consistent.

In the following paragraphs, I describe Braun's and Clarke's (2022) six phases of reflexive thematic analysis and share my own research activities that were undertaken for each phase.

Phase 1: Familiarization with the Data. During this phase, the researcher reads or views the data several times and writes memos and notes. In these memos and notes, the researcher records initial ideas, items of interest, their response to the data, and documents underlying assumptions. Braun and Clarke (2022) stated that transcription is part of this data familiarization. My Phase 1 activities included transcription, printing the transcripts, re-reading, and writing notes in the margins of the transcripts. I re-read transcripts after each interview, and once interviews were complete.

Phase 2: Coding the Data. In Phase 2, initial codes are developed. Braun and Clarke (2022) described codes as the "smallest unit of analysis and...the building blocks of analysis in reflexive thematic analysis" (p. 52). They recommended being over-inclusive during this stage; if in doubt, code the data item. Codes developed by the researcher may be semantic (directly representative of participants' meanings) or latent (going beyond the surface of the participant's message to examine underlying meanings (Braun & Clarke, 2022)). This stage concludes with the development of a list of codes and all the data linked to each code.

It was during Phase 2 that I started using NVivo 12 Plus (QSR International, 2022). Uploading my transcripts to folders based on each case of my multiple-case study, I reviewed each teacher's transcripts before moving on to the next case. I used NVivo to develop initial codes, seeking to code anything that appeared relevant and might support my research questions.

My ideas for codes from Phase 1 proved helpful at the stage. Examples of codes used included *iPads are versatile and valuable*, *SMART Board for whole class instruction*, *SMART Board as predictable classroom routine*, *technology for student motivation and engagement*, *technology for teacher access to resources*, *YouTube to practice skills across subject areas*, *Seesaw for parent communication*, *choosing remote learning tools that work for families*, and *outdated technology as a barrier*.

Phase 3: Generating Themes. Braun's and Clarke's (2022) work differed from their original 2006 work in that they very specifically address theme generation. In 2006, they described Phase 3 as *searching for themes* which they later felt gave the impression that the themes existed in the data just waiting to be uncovered by the researcher. Instead, researchers must engage in an active and interpretative process to develop themes. Good themes are distinctive and part of a larger whole (Braun & Clarke, 2022). Phase 3 ends with gathering all the coded data linked to each theme. At this point, themes are potential themes only and may change many times.

For my process, I copied and pasted codes in NVivo 12 Plus (QSR International, 2022) as I explored different themes. Although I experimented with many ideas for themes, none seemed quite right, and I was struggling to visualize the data as a whole. I decided that I needed to see everything in front of me in one physical space. For one case, I printed all the codes on paper, cut them into small strips, and started sorting and grouping on a table. Every time I walked by that table, I reviewed the themes I had created and made adjustments. After engaging in this process once, I was able to sort and group the codes into themes using NVivo 12 Plus for the remaining three cases.

Phase 4: Reviewing and Developing Themes. In Phase 4, the researcher continues to review and develop themes, identifying the nature or character of the themes (Braun & Clarke, 2022). Researchers are encouraged to consider the quality and boundaries of themes, querying if there are enough meaningful data to make a theme or if the data that is too diverse and broad for one theme. The researcher must also confirm if the themes fit in relation to the coded extracts and the entire data set. Braun and Clarke (2022) related that the best themes tell multi-faceted stories. This stage ends with the development of a thematic map.

During this stage, I continued to create, combine, separate, and discard themes until I had developed three or four themes per case. I tested the themes by reading all the coded extracts that were linked to the theme to determine if they represented the essence of the theme. Some themes were similar across the four cases and others were quite distinct. For example, all teachers had a theme that focused on integrating technology to communicate and build community while only two teachers had a theme that included using technology for organization and structure.

Phase 5: Refining, Defining, and Naming Themes. In Phase 5, the researcher refines theme names and labels. Multiple levels may exist, including overarching themes (used to organize related themes), themes, and sub-themes, but there should be no more than three theme levels. Theme levels are not a requirement of reflexive thematic analysis and should only be used if they are helpful to the researcher (Braun & Clarke, 2022). Phase 5 concludes with refining the specific details of each theme and how they relate to the overall narrative of the research.

In this phase, I reviewed all my themes and rejected or reworked any that appeared to be topic summaries rather than themes. I also considered each one carefully through the lens of my research questions to determine how well they addressed these guiding questions. I experimented with different theme names. Finally, I made decisions about which themes were most

representative of each teacher (e.g., Danielle's themes included *Technology Integration for a Structured and Organized Learning Environment*, *Fostering Community and Engagement with Technology*, and *Technology Integration for Personalized and Purposeful Learning*) and how I could create vignettes that showcased each educator's technology integration practices based on the themes I had developed.

Phase 6: Producing the Report. This is the researcher's last chance for analysis, which includes analytic commentary, data extracts, and themes. Braun and Clarke (2022) recommended a final report that includes 50% data extracts and 50% analytic narrative, urging the researcher to represent all participants' voices; not just the most compelling ones. Analysis must be related to the research questions as well as the wider context in the literature. Researchers may still disregard themes in this final stage. Lastly, analytic conclusions are drawn out across themes.

At this point in my work, I developed vignettes for each of the four teachers that are shared in Chapters 4 and 5. After providing an introduction that included the teachers' backgrounds and pedagogical beliefs, I presented two snapshots of practice that I felt were most compelling and descriptive of how they integrated technology. Each snapshot included student work samples and/or teacher social media posts, was linked to the theoretical foundation and the literature, and included my analytic conclusions.

Cross-Case Analysis. At this point, the single cases comprising a multiple-case study have been examined separately, and the data are organized into a comprehensive, holistic entity (Chmiliar, 2010; Yin, 2018). I was uncertain of how to organize my four cases in NVivo 12 Plus (QSR International, 2022) to conduct a cross-case analysis and could find no answers online or in the course I had taken. Therefore, I contacted a webinar presenter from Lumivero (NVivo's parent company) with my questions and he provided an immediate response which solved my

problems. I created a new folder in NVivo 12 Plus labelled *Cross-Case Analysis* and copied and pasted the themes and codes from each teacher's folder. This allowed me to sort and group codes and themes without altering my previous work for each teacher. I assigned a distinct colour to each teacher's codes and themes, and as I grouped common ones together, I was able to tell at a glance if all teachers were represented. At this point, I developed two overarching themes that were interwoven throughout four other themes. As I considered similarities and differences among teachers, I frequently referred to the teacher classification sheet that I had developed in NVivo 12 Plus. This classification sheet included 24 attributes such as *uses Twitter*, *number of iPads*, *SMART Board*, and *coding or robotics*.

Themes were organized into visual displays with a narrative description and specific examples provided for each teacher. At the conclusion of the theme, unique differences in practices were detailed to provide contrast among the four cases. The cross-case analysis is presented in Chapter 6.

Integration of Qualitative and Quantitative Results

After completing both quantitative and qualitative data analysis, integration of both forms of data was the next step in my research design. This was accomplished by merging the quantitative results with the qualitative findings to establish if any new insights were yielded when viewed holistically. According to the recommendations of Creswell and Plano Clark (2018), this phase includes three steps: i) report the quantitative results in narrative form; ii) report the qualitative results in narrative form; and iii) place the key findings of both the quantitative and qualitative data in an integrated visual representation (such as a table or other form of joint display). By engaging in these three steps, side-by-side comparison of both forms of data was made possible and new understandings were reached.

Trustworthiness and Authenticity of the Study

Research findings must demonstrate trustworthiness if a researcher wants to make a contribution to the field and put the knowledge created by their research into practice. Lincoln and Guba (1985) insisted that in order to achieve trustworthiness, research must meet the criteria for credibility, transferability, dependability, and confirmability. I have employed a number of strategies to ensure that my research meets the requirements for trustworthiness.

Credibility

Credibility refers to the alignment between participants' views and the researcher's portrayal of them (Tobin & Begley, 2004). To achieve credibility, I relied on prolonged engagement, member checking, and data triangulation. I maintained prolonged engagement with my research participants, conducting interviews from January-August 2021. As I completed transcripts, I emailed them to participants and requested that they check them for accuracy, make any changes, and return them to me. While writing this dissertation, I have contacted my research participants to confirm that my descriptions of them, their schools, and school divisions are accurate and reflect what they would like shared. All participants read and approved their vignettes, offering suggestions to clarify aspects of their practice. Finally, multiple sources of data (survey results, interview transcripts, reflexive journal, and student work samples) allowed for triangulation.

Transferability

Transferability is linked to the generalizability of the research findings (Nowell et al., 2017). Of course, the researcher does not know who will read their research in the future and seek to apply it to their setting. Therefore, I aimed to provide thick description (Geertz, 1973) so that other researchers and educators who are interested in transferring my findings have an

abundance of information. Ensuring that I provide information about context as well as participants' experiences and opinions enhances transferability (Korstjens & Moser, 2018).

Dependability and Confirmability

A logical and well-documented research process that can be followed by others is crucial to establishing dependability (Tobin & Begley, 2004). My research was guided and checked by my principal supervisor to help me maintain consistency. Consistency refers to ensuring that the analysis process is aligned with the standards for the research design (Korstjens & Moser, 2018). Regular conversations with my principal supervisor via email and video call provided answers to my questions as well as suggestions for articles and other resources to guide me.

Dependability also includes the research participants' evaluation of the findings (Korstjens & Moser, 2018). As previously mentioned, my research participants reviewed the vignettes that were developed for each of them to confirm that they were an accurate representation of their technology integration practices. Vignettes were provided to the participants through shared documents in Microsoft OneDrive. Participants read the vignettes, highlighted and made any necessary changes, then confirmed their approval of the vignettes via email.

Confirmability may be achieved by documenting my theoretical, analytical, and methodological choices throughout my research process so others can ascertain that my conclusions were clearly drawn from the data (Nowell et al., 2017; Tobin & Begley, 2004). An audit trail is an important strategy for maintaining dependability as well as confirmability (Korstjens & Moser, 2018). As explained in an earlier section, I used Microsoft OneNote to manage my research process. A section of this OneNote was dedicated to a reflexive journal with a page for each research participant. In this space, I documented my reflections and future lines

of inquiry. This enabled me to map all the steps in the data collection process and maintain an audit trail. Additionally, meeting the criteria for credibility, transferability, and dependability as described above establishes confirmability (Guba & Lincoln, 1989). By undertaking these steps and procedures, my research will be strengthened and made more acceptable and useful to others.

Summary

In this chapter, I discussed the research design and outlined the specific methods selected to investigate Kindergarten-Grade 2 teachers' technology-supported teaching practices. In the beginning section, I provided an overview of mixed-methods approaches and shared my rationale for use of these methods. In the second section, I discussed how research sites and participants were chosen and offered a description of the participants and their school and classroom contexts. Next, I explained the quantitative and qualitative data collection procedures used. This was followed by an account of data analysis procedures and a discussion of my positionality as a researcher. The chapter was concluded with an examination of the four components of trustworthiness and how I have addressed them in my research.

Chapter 4: Quantitative Survey Results and Vignettes of Rural Teachers' Practice

In this chapter, I present the data generated by the quantitative survey and two teacher vignettes drawn from the qualitative multiple-case study. Following a brief review of the previous chapters, I discuss the quantitative data gathered by a survey administered to Kindergarten-Grade 2 teachers in the participating rural and urban school divisions. The survey results are shared through narrative descriptions as well as charts and graphs. After presenting the quantitative data, I draw from my qualitative data to provide illustrative examples of how the rural participants integrated technology into their classroom practices. In each vignette, I outline teachers' technology use through the lens of the following research questions: i) How is technology used in primary classrooms?; ii) What are primary teachers' purposes for integrating technology?, and iii) How has the pandemic shifted primary teachers' technology-supported practices?

As discussed in Chapter 2, a review of the literature indicated that complex and interrelated factors influence how and why teachers integrate technology. Determinants of teachers' technology use include their feelings of self-efficacy, confidence, and competence, their pedagogical beliefs, and the intrinsic and extrinsic barriers they experience. The digital divide continues to pose a significant barrier, especially to rural teachers who struggle with connectivity issues. Although technology is ubiquitous, some educators experience tensions among traditional discourses, play-based pedagogy, and digital pedagogy. As outlined in the literature review, teachers integrate technology for a variety of reasons (e.g., assessment, family communication, lesson planning, global collaboration). In the past, teachers' technology integration practices were varied; the global COVID-19 pandemic that began in 2020 unified all educators in their need to use technology for remote teaching. During the pandemic, teachers

relied on learning management systems, synchronous and asynchronous learning activities, and videos to maintain educational continuity. In the next section of this chapter, the quantitative data from the survey are presented and analyzed.

Quantitative Data: Survey Results

In the fall of 2020, school division personnel distributed my 13-item online survey by email to all Kindergarten-Grade 2 teachers in the participating rural and urban school divisions. The purpose of this survey was to obtain a broader overview of how and why teachers integrated technology and to recruit four teachers for the multiple-case study. Since the quantitative survey preceded the case study, the responses provided direction for the questions I asked the case study participants in the semi-structured interviews. Twenty-eight respondents (16 rural, 12 urban) completed the survey. The results are shared with a combination of narrative description, charts, and tables for each question.

The survey began with three demographic questions with the fourth question investigating years of Kindergarten-Grade 2 teaching experience. Options were presented in five-year ranges with the greatest number of respondents (36%) teaching for 6-10 years. Thirty-two percent of respondents had been teaching for 0-5 years, while 18% had taught for 11-15 years and 14% for more than 16 years.

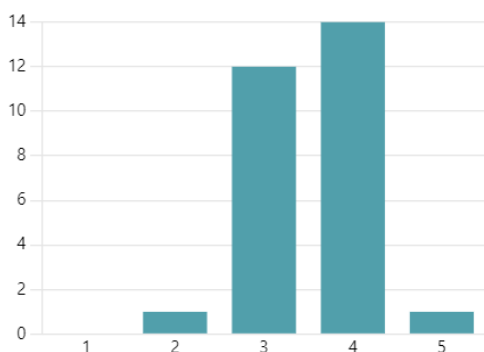
For the fifth question, the survey probed teacher confidence with classroom technology integration using a five-point scale (1=not at all confident, 5=extremely confident). As detailed in the literature review, teacher confidence is a determining factor of successful technology integration (e.g., Ertmer & Ottenbreit-Leftwich, 2010; Jack & Higgins, 2019; Nikolopoulou & Gialamas, 2015). The mean for survey respondents was a score of 3.54 with a mean of 3.58 for urban teachers and a mean of 3.50 for rural teachers. The median response was 3.50 and the

mode was 4. These descriptive statistics indicated that most respondents felt reasonably confident with technology integration regardless of their urban or rural locations.

A Mann-Whitney-Wilcoxon Test³ was performed at the 5% level of significance to determine if rural and urban teachers differed with respect to how confident they felt when integrating technology in the classroom (U=89, p-value=0.7354). There was insufficient evidence that rural and urban teachers differed in how confident they felt integrating technology in the classroom. As no respondents selected a rating of one and only one teacher selected a rating of two, it is possible to conclude that 96% of survey respondents felt reasonably confident to very confident in classroom technology integration (see Figure 2 below).

Figure 2

Teachers' Level of Confidence When Integrating Technology



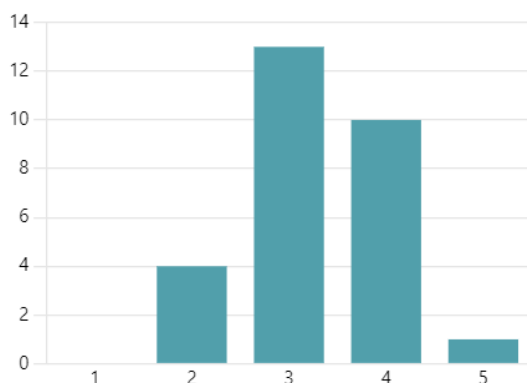
The sixth question investigated how teachers rated their ability to successfully integrate technology in their teaching practice using a five-point scale (1=beginner, 5=expert). The mean score was 3.29, with urban teachers showing a slightly higher mean of 3.42 and rural teachers

³ The Mann-Whitney-Wilcoxon Test (also known as Wilcoxon Rank Sum Test) is a non-parametric form of the two-sample t-test used when assumptions are not met. This test determines if the two populations appear to be the same based on the ranks of the values (University of Virginia Library Research Data Services and Sciences, n.d.).

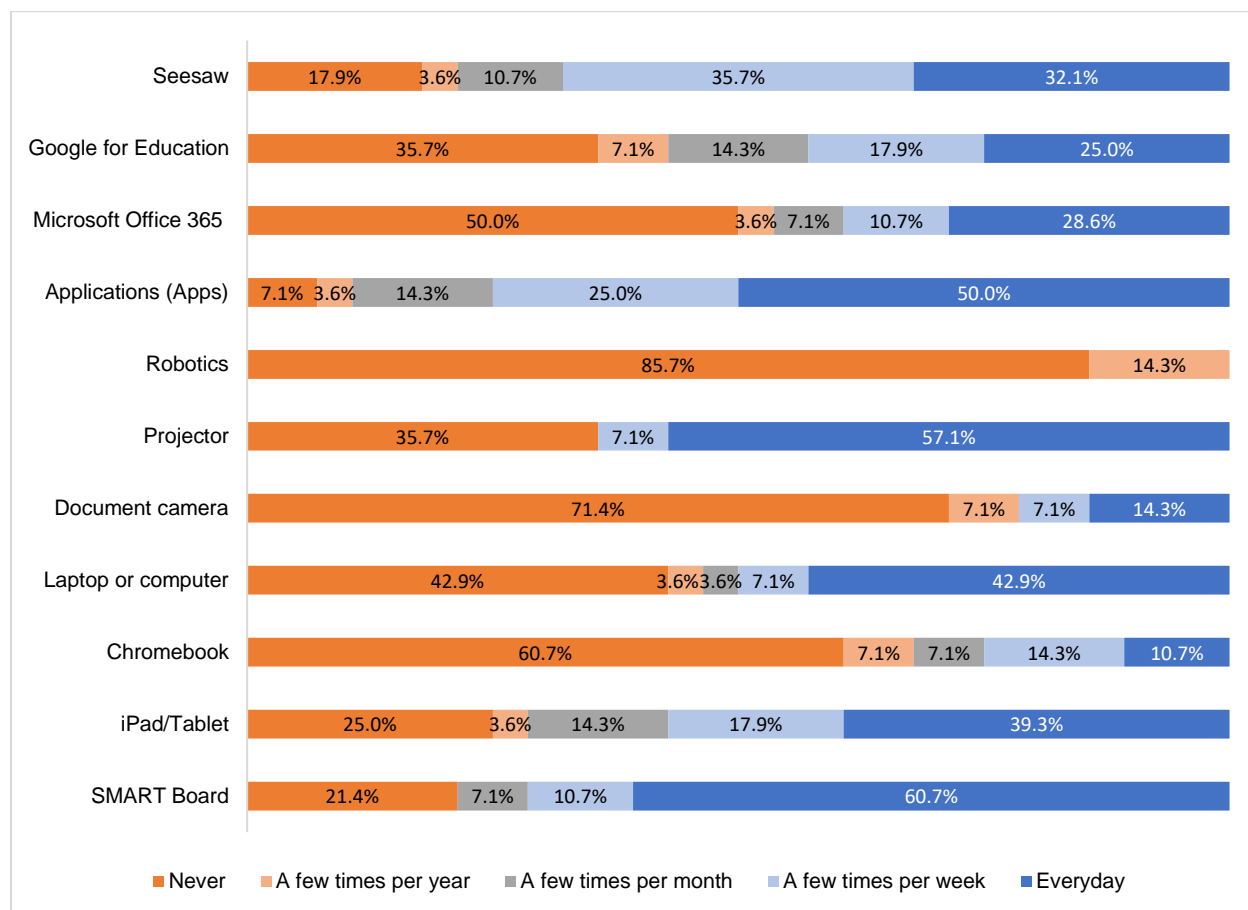
reporting a slightly lower mean of 3.19. The median and mode were 4.00. A Mann-Whitney-Wilcoxon Test was performed at the 5% level of significance to determine if rural and urban teachers differed when rating their ability to successfully integrate technology in the classroom ($U=77.5$, $p\text{-value}=0.3654$). There was insufficient evidence that rural and urban teachers differed in this area. Since 85% of teachers selected a rating of 3 or higher, it is possible to conclude that most survey respondents felt competent in their ability to integrate technology (see Figure 3).

Figure 3

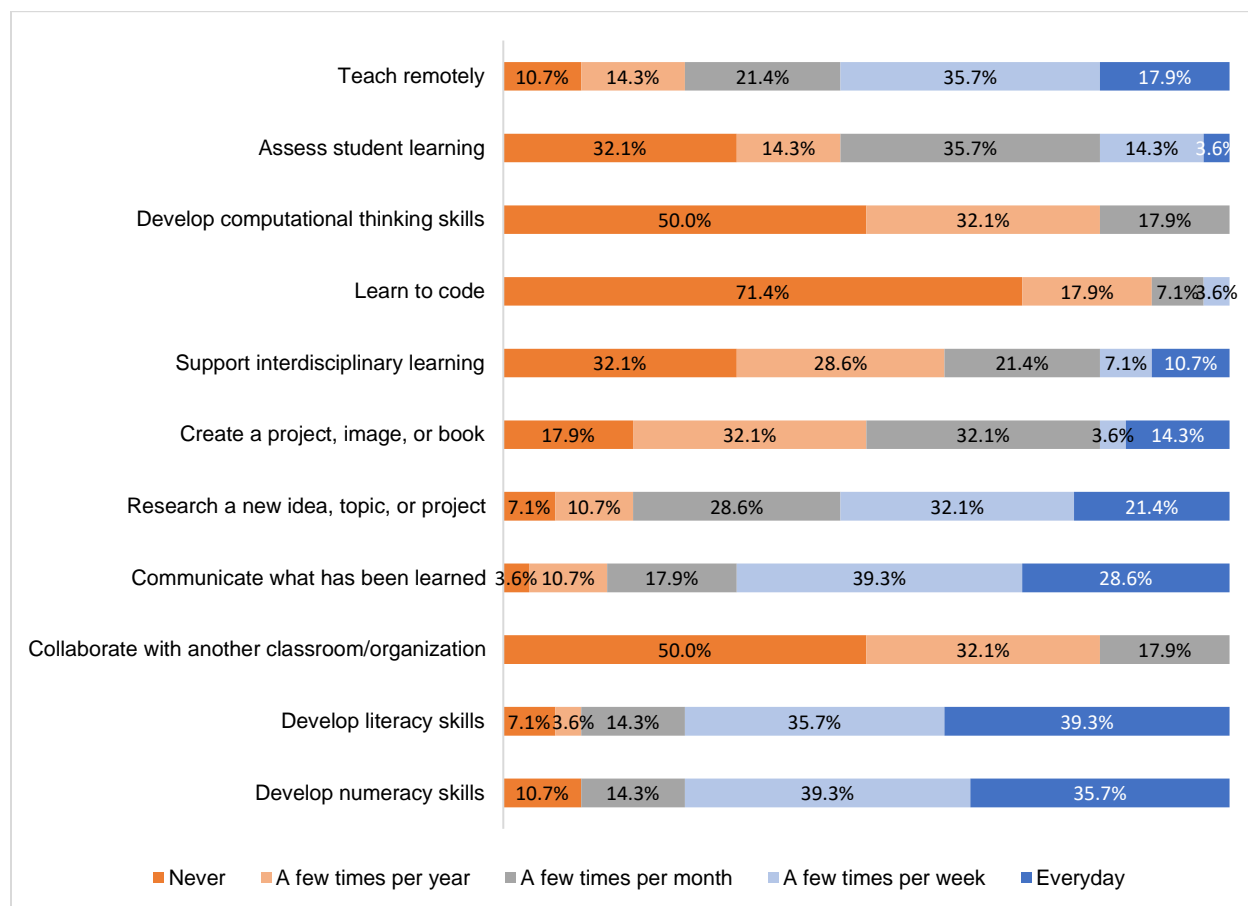
Teachers' Ability to Integrate Technology Successfully in the Classroom



The frequency of device and tool use in teachers' classrooms was queried using a scale of every day, a few times per week, a few times per month, a few times per year, and never. The most frequently used technology tools in Kindergarten-Grade 2 classrooms were interactive whiteboards (61% reporting daily use), projector (57% reporting daily use), apps on devices (50% reporting daily use), laptop or computer workstation (43% reporting daily use), iPad or other tablet (39% reporting daily use), and Seesaw (32% reporting daily use). Tools that were used the least included Chromebooks, document cameras, and robotics. More information is provided in Figure 4.

Figure 4*Frequency of Technology Device/Tool Use in Classroom*

Teachers' purposes for integrating technology in their classrooms were an important aspect of my study. When asked to rate how often they integrated technology for specific purposes in the past school year, teachers responded that they used technology on a daily basis for the following reasons: i) develop literacy skills (39%); ii) develop numeracy skills (36%); iii) communicate or share what had been learned (29%); iv) research a new idea, topic, or project (21%); and v) teach remotely (18%). Few teachers used technology daily to create a product, image, or book, to support interdisciplinary learning, or to assess student learning. No respondents used technology daily to collaborate, to learn to code, or to develop computational thinking skills (see Figure 5).

Figure 5*Frequency of Technology Integration for Specific Purposes*

When responding to the ninth survey question, teachers expressed strong convictions that technology belonged in a Kindergarten-Grade 2 classroom. When asked to rate their feelings about technology using a 5-point scale (1=does not belong in a Kindergarten-Grade 2 classroom, 5=they love integrating technology), all respondents chose a rating of 3 or higher. The mean was 3.71, the median was 4.00, and the mode was 3.

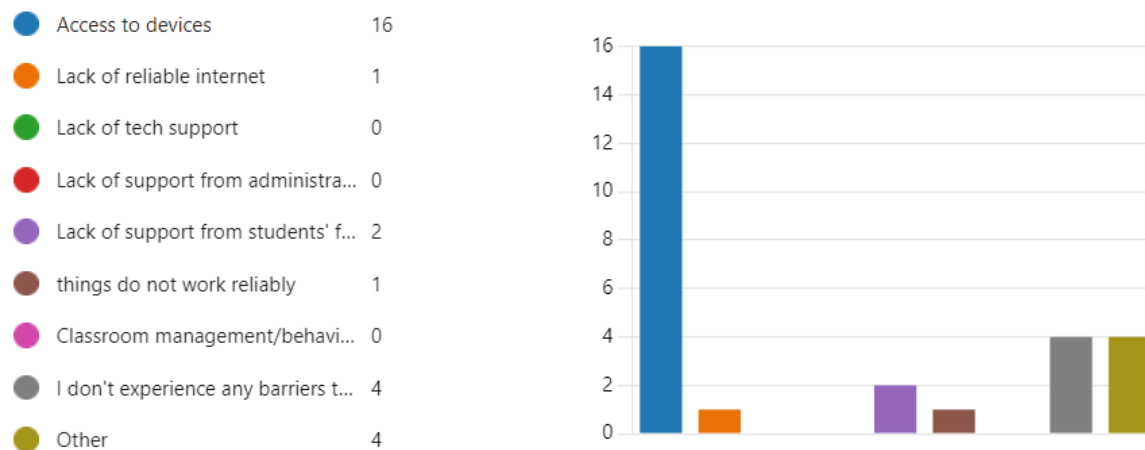
Teachers were also questioned about their single most important reason for integrating technology in their classrooms. Respondents indicated that their main reasons were to increase student engagement (46%), to provide options for learning that would not be possible otherwise

(29%), and for remote teaching and learning (18%). One respondent indicated that it increased their engagement as an educator while another respondent selected *other*.

First and second-order barriers to technology integration are well represented in the literature (e.g., Ertmer, 1999; Ertmer et al., 2012; Ertmer & Ottenbreit-Leftwich, 2010), and the eleventh question investigated the barriers experienced by the respondents. The most common barrier faced by 16 of the responding teachers was access to devices. This is consistent with the device access issues documented by Burke et al. (2018), Karchmer-Klein & Konishi, (2021), and Nantais et al. (2021). Four teachers reported that they experienced no barriers in their efforts to integrate technology while two teachers indicated that they faced a lack of support from students' families. For more information, see Figure 6.

Figure 6

Technology Integration Barriers Experienced by Teachers



To conclude the survey, respondents were given an opportunity to share anything about how and why they integrated technology. Nine responses were collected and coded and are shared as relevant in the cross-case analysis. Examples of codes used include *lack of devices*,

preparing students for the future, technology for French immersion, children as more knowledgeable others, and technology is engaging for students.

In the next section, I present vignettes of the two rural teachers' technology-supported practices. These vignettes are designed to showcase how Danielle and Heidi typically integrated technology and provide context as well as authentic examples of the tools and uses highlighted in the survey. These vignettes include the following: i) a description of the teacher; ii) excerpts from conversations with the teacher; iii) work sample(s) created with technology from the teacher's practice, and iv) my analysis and reflection on the teachers' purposes for integrating technology. Additionally, I connect the practices depicted in the vignettes to the literature and the theoretical framework of my research. Data were gathered for these vignettes from January-June 2021 during COVID-19 restrictions that included physical distancing requirements, sanitizing, and masks for teachers. All students and most educators were unvaccinated as vaccinations only became widely available to adults in late April/early May 2021. As a result of these restrictions, classroom observations were not possible. Data sources for the vignettes included interview transcripts, my reflexive journal, teachers' social media posts, and anonymized work samples shared by the teacher.

By including these vignettes, I aim to provide the reader with a portrait of the teachers' classroom practices, as well as an opportunity to compare and contrast the teachers' beliefs and practices with those outlined in the literature. Although it is evident that each teacher integrated technology for multiple purposes, the selected examples for each teacher provide different perspectives of the possibilities presented by technology integration. A variety of technology tools are mentioned throughout these vignettes. For more information, please see the glossary in Appendix F.

Vignettes of Rural Teachers' Technology Integration Practices

Teacher #1, Rural: Danielle

At the time of data collection, Danielle was in her seventh year at Binscarth School, although she had been teaching for 10 years in total. Danielle taught 17 children, with 10 students in Kindergarten and seven in Grade 1. Binscarth School is a Kindergarten-Grade 8 school with an enrolment of 60 students. The generous support of a community service group supplemented the technology available in the school, and this resulted in excellent access to technology for the staff and students. Danielle had a SMART Board⁴, a teacher laptop, and five classroom iPads, with access to 20 more iPads if needed. She also had iPods for students to listen to music and stories. Access to high-speed fibre optic Internet aided Danielle's efforts to integrate technology as well as the option of seeking support from the division technology integration coach. The technology integration coach was available by appointment to all teachers in the school division for mentoring, co-teaching, professional learning, and equipment loan such as robots. Danielle shared that she did not book sessions with the technology integration coach as she felt confident in her abilities. However, she had asked her for suggestions for apps and websites and found the ideas very worthwhile.

Danielle described herself as a confident technology user with intermediate skills. She was not afraid to use technology in her personal or professional life and she was comfortable troubleshooting issues as they occurred. Outside of school, Danielle relied on technology for entertainment (e.g., video and music streaming), online shopping, and personal and farm

⁴ Manufactured by SMART, a SMART Board is an interactive whiteboard that uses touch input such as finger pressure or the provided stylus. The one described in this vignette is connected to a computer and the computer's display is mirrored on the SMART Board with a projector.

financial management. She enjoyed using Facebook and Instagram but did not integrate social media into her classroom practice. Danielle appeared to display a very positive attitude towards technology integration.

Similar to most educators around the world, Danielle taught remotely in the spring of 2020. She noted that pandemic teaching conditions made her realize that few teachers were experienced technology users and she observed how difficult it was for those teachers to transition to emergency remote teaching. Danielle hoped that sharing her classroom practice would help other teachers see the many possibilities for technology integration with young children. During the 2020-2021 school year, she taught in person with many changes to her classroom space and practice. Individual student desks had replaced flexible seating options and they were spread out across the classroom occupying all available space. Danielle shared that her students no longer had access to play and group work, noting that children were deprived of social interaction and collaborative learning opportunities. To adjust to these pandemic regulations, she created new individual play activities that students enjoyed at their desks.

Danielle preferred a structured and routine-based classroom where she and her students knew what to expect from one day to the next. She described her pedagogical beliefs as midway between teacher-centred and student-centred, with a shift to more student-centred practices as the children became more independent throughout the school year. Danielle liked to function as a facilitator who scaffolded instructions and provided opportunities for hands-on learning and play. She believed that strong connections with students and their families were essential for learning to take place. She leveraged the affordances of technology to strengthen home and school connections during the ongoing pandemic. In the following vignette, I describe how Danielle integrated technology to foster stronger relationships and communication.

Vignette #1a: Fostering Connection and Communication with Technology. Danielle related that technology played a key role in connecting with families and sharing student work and classroom experiences as they happened. She believed that this ongoing, regular communication with families enhanced her relationships with the children she taught. Danielle accomplished this ongoing connection with families and their children by integrating [Seesaw](#), a web and app-based platform with different interfaces for students, families, and educators. This online learning management system has a learning journal or portfolio for each child and the ability for families, children, and educators to communicate instructions, caption work samples, and comment using audio, video, images, and text. Teachers can create and assign learning tasks through the learning journal and publish student work to a public or password-protected blog. A communication component allows teachers and families to communicate through a text messaging format. The basic features of Seesaw are free without advertising, and additional features are available with a premium subscription. Danielle's school division provides the premium features for all classrooms.

Devon: Tell me about how you use Seesaw in your classroom.

Danielle: Currently I would say I use it in maybe three ways. The first one is students are allowed (after they learn how to do it) to put pretty much anything that they're proud of, or that they want to share with their families in Seesaw. The other thing is, when we do get close to report card time, and parent-teacher interviews, I will make sure that there are certain things that we do put in there to give their parents a current snapshot. Like we'll make sure we have something math-related, something ELA-related (English Language Arts). And then they'll pick something from Science or Social Studies to put in there. It's

been a good tool because I can put work for them to get done at home, and they can also share what they've been doing at home with me on there.

Devon: Okay, so, once your students are independent with using Seesaw, they're able to grab a classroom iPad, and photograph something they've created and put it in their Seesaw learning journal.

Danielle: Yes.

Devon: How about parents? How do parents use Seesaw?

Danielle: Parents are able to comment on their student's work. I actually missed a way that I use it, I also use it sort of as a blog, I don't use Seesaw's actual blogging feature though. I'll just upload what I want to share to all the students' accounts. But any artwork or special things we've done, I put in there. So, then parents are able to view it and comment and interact on there. And I do have a few families that when kids want to share something from home, because they don't have show and tell or anything like that, they'll snap some pictures at home and put it in their Seesaw account. And I can see it there.

Devon: What are your main purposes for using Seesaw in your classroom?

Danielle: I was looking for something to replace the paper-type portfolios so that families could view work in real time. It's a way to engage parents and families. It's tricky to get a lot of parent feedback, everybody's busy. But I have had a couple of parents say that they really enjoy getting those little updates, and then they have a starting point for talking about school at home. Instead of just asking them what they did at school, they have something that they know their student did, and they don't have to go digging for information about school.

Devon: Is Seesaw a solution for any problem you're trying to solve in your classroom?

Danielle: The parent and family engagement piece. Ninety-five, even 99% of parents probably have a smartphone. And the Seesaw app is free for them to download, and they get a notification as soon as something has been put in. So, that engagement piece has been really nice.

Transcript: May 17, 2021

Danielle expressed that Seesaw was one of her most effective communication tools as parents and caregivers had ready access to it on their mobile devices throughout the day.

Danielle shared that this positive family and teacher communication had shifted the typical parent-teacher conference. Before using Seesaw, Danielle would spend most of the conference sharing student work samples in a paper portfolio with only a few minutes for conversation. With Seesaw, family members were familiar with their children's work before attending the conference which created greater opportunities for discussion. Danielle shared that parents were alerted to any strengths or weaknesses in advance and they arrived with deliberate questions and talking points. For example, families would have already viewed this [Seesaw Student Writing Sample](#) in which a child filmed their journal entry as they read it aloud. In the video, Danielle asked the student questions about their work and discussed how the student had met some of the pre-set criteria and how they could continue to grow as a writer and illustrator. This sample was viewed and commented on by parents and would only be discussed at a conference if the family had questions or required further information.

When Danielle introduced Seesaw at the beginning of each school year, she modelled it for the whole class on the SMART Board using the Seesaw website. At first, students experimented with adding photographs to their learning journals, and when they demonstrated mastery, Danielle taught them how to add a recording. In their initial audio recording, students

described what they were adding to their journal, what they learned, and why it was important to them. She also guided students individually when they needed more support. Danielle explained that once students started uploading work samples to their learning journals, parents could comment and ask questions and she could respond. Her school principal also had access to student learning journals and they provided the students with feedback on a regular basis.

Danielle's students had access to the iPads throughout the school day to document and share their learning through the Seesaw app. She felt that her students' ability to share work with their families independently gave children increased ownership and helped them feel more secure and connected. Danielle related that some of her Kindergarten students experienced separation anxiety throughout the day and it helped when they were able to share their classroom activities and creations with their families. This work sample, [Seesaw Loose Parts House](#), was uploaded independently by a student during play time. Danielle explained that this loose parts activity was something she developed for independent play during the pandemic. Students had containers of loose parts to choose from and could construct whatever they liked. This student recorded an audio caption and shared that they wanted to upload this video to Seesaw because an aspect of building it was "really hard". Edited from the video to protect student privacy, it showed that both parents had viewed and liked this learning journal entry. The school principal had commented, "Nice house! I like the door." A similar activity that students enjoyed for individual play during the pandemic was constructing a dinosaur habitat as shown in Figure 7.

Figure 7

Student-Created Dinosaur Habitat



Note. Created during independent play time at the student's desk, the student photographed the dinosaur habitat, uploaded it to Seesaw, and captioned it independently.

Danielle shared many advantages to using Seesaw in her teaching practice, but also acknowledged the challenges of a tool that requires family device access and Internet or cellular data. She explained that three of her students did not have a caregiver or family member connected to their Seesaw accounts. Usually, Danielle would guide family members through the setup process at the start of the school year when families visited in person, but these in-person visits were curtailed due to the pandemic. She commented that these students were less engaged in using Seesaw than their peers who were connected with families on the platform.

Analysis of Vignette. Danielle's desire to strengthen connection and communication among her students, their families, and herself was facilitated by technology and well-aligned with sociocultural theory (Vygotsky, 1978) and multiliteracies theory (New London Group, 1996). In her classroom, children learned through connecting and communicating with each

other as well as with the adults in their lives using cultural tools. These cultural tools increased the quality of communication modes as well as the quantity of communication to extend the world of the classroom into the home. Knauf's (2016) notion of an interlaced social world through classroom social media is very applicable to Danielle's integration of digital tools. By drawing on the affordances of Seesaw, Danielle's classroom walls had extended into the virtual sphere. It had become a social world that included children, their families, the teacher, and the school administrator. Danielle's goal was to foster deeper connection and improved communication, and Seesaw made this possible with no temporal or location constraints. As Danielle's students shared their learning throughout the school day, they connected asynchronously with people outside their classroom. The social world of the classroom extended into the social worlds where parents were located throughout their days (Knauf, 2016). When students used Seesaw to post something important from home for Danielle and their peers to view at school, the social world of the home extended into the classroom.

Through her use of scaffolding and her role as the more knowledgeable other (Vygotsky, 1978) as she taught her students to use Seesaw, Danielle fostered greater agency in her learners. With this agency and the availability of devices, Danielle's students were no longer passive in parent-teacher conversations. They initiated conversations with their Seesaw posts and functioned as active participants with captions and comments (Knauf, 2016). Instead of only consuming content, they created content independently through their use of the iPads and Seesaw app. The student-generated Seesaw posts that were shared within this expanded digital social world provided insight into what Danielle's students value and view as important artefacts of their learning.

Danielle's integration of technology to communicate and connect also enhanced classroom assessment practices. The affordances of tools such as Seesaw to strengthen assessment practices were documented in the research (e.g., Danniels et al., 2020; Masoumi, 2015; Milman et al., 2014). Similar to what had been described in the literature, Danielle and her students used technology to capture, share, and organize student work (Milman et al., 2014) and to communicate and document classroom practices (Masoumi, 2015). It was common for teachers to document numeracy and literacy learning, but capturing what occurred during play had been more difficult for educators. Danielle's integration of the Seesaw app and iPads improved her ability to document and share what occurred during play (see [Seesaw Loose Parts House](#) and [Figure 2](#) in previous vignette); this echoed findings from a study by Danniels et al. (2020) also shared in Chapter 2. They noted that iPads and Seesaws allowed teachers and students to capture not only products but process during play, strengthening links to curricular outcomes and assessment as and for learning.

Danielle used Seesaw as her main learning management platform during remote teaching in the spring of 2020. She continued to rely on it to assign work and provide feedback when students were at home due to COVID-19 isolation protocols. Although this was convenient and useful, Danielle had at times expressed uncertainty about who had completed the work which had been echoed by educators teaching remotely in other studies (e.g. Cooper et al., 2021; Timmons et al., 2020, 2021).

Lastly, the barrier of rural connectivity was described in the above vignette as an issue for three of Danielle's students. This emerged as a significant problem in areas of Manitoba (Kotak et al., 2021; Nantais et al., 2021) and it was an obstacle that hampered Seesaw family

connections. In the next vignette, I present examples of Danielle's technology integration practices to meet curricular outcomes and develop important early skills.

Vignette #1b: Technology to Meet Curricular Outcomes and Develop Skills. Danielle seemed to be very intentional with her integration of technology to address and enhance student learning. As a Kindergarten and Grade 1 teacher, she prioritized the development of early literacy and numeracy skills to provide a solid foundation for her students to succeed academically. She regarded technology as an important tool for engaging her learners, personalizing their learning, and providing repetition and practice. In her practice, technology use enabled her to source new resources and implement the curriculum more effectively. In this vignette, I describe Danielle's technology-supported teaching practices to deliver the curriculum and strengthen her students' literacy and numeracy skills.

Throughout our interviews, Danielle reiterated that technology integration must be purposeful, intentional, and appropriate. She commented that technology was very engaging to children, and they looked forward to using it, but it was important to select the apps or tools that strengthened literacy and numeracy skills. Danielle was also cognizant of how important it was for technology to be balanced with other hands-on experiences and carefully monitored by an adult. She was deliberate in her teaching and planning and began by consulting Manitoba English Language Arts, Mathematics, Social Studies, and Science curricular documents then considered children's needs, abilities, and prior knowledge.

Danielle's main technology tools for implementing the curriculum and building literacy and numeracy skills were her SMART Board interactive whiteboard and classroom iPads. Using teacher-created slides and websites, the SMART Board was often the focus of whole-class

learning. The classroom iPads with teacher-selected apps were used for personalized skill development and practice.

Danielle had used an interactive whiteboard her entire teaching career and relied on her SMART Board for whole-group instruction and organization of learning materials. Danielle described her SMART Board as providing structure to her teaching and an interactive and engaging visual support to learners. Her use of the SMART Board helped her establish routine and teach the curriculum in a structured and organized manner. She related that her SMART Board makes teaching very convenient as she could have English Language Arts (ELA) and Mathematics lessons prepared for the week and ready to use. Additionally, since the SMART Board was a touchscreen, it enabled Danielle to be in front of her students for instruction rather than moving back and forth to a teacher computer. The touch features of the screen ensured that learning is an interactive experience rather than just a projection screen for content.

A secondary benefit of SMART Board use has been the development of students' technology skills. Without teaching technology skills in isolation, Danielle recounted that the students observed how she used the SMART Board and then used it themselves with her guidance and support. Danielle said that she frequently modelled and explained what she was doing on the SMART Board so that her young learners could strengthen their information and communication technology (ICT) skills and increase their knowledge of ethical and responsible technology use. For example, when she sourced an image online to use on a SMART Notebook slide, she discussed with her students that she had chosen a copyright-free image that she had permission to use.

Danielle shared that her SMART Board is used throughout the day in her classroom in blocks of 5-25 minutes. Using SMART Notebook software and Google Slides, Danielle created

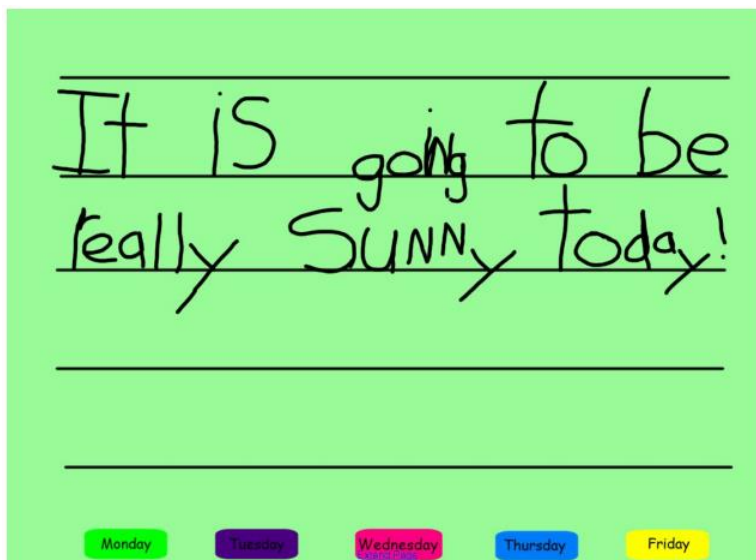
learning experiences as well as organizational tools for projects, centres, and play. The students' day began with calendar at the SMART Board. This daily calendar served as a hub of Mathematics and ELA activities as well as the traditional calendar and attendance routine. These activities included reading and listening, shared writing, phonological and phonemic awareness practice, counting, patterning, and problem-solving. Using hyperlinks on her calendar slides, Danielle had different activities for each day of the week to target a variety of evolving curricular outcomes and skills that she prioritized. For example, Danielle began each day with a SMART Notebook attendance activity that she created. Designed as a two-circle Venn diagram with names along the side, the student helper of the day posed a question (e.g., Do you like pancakes, waffles, or both?) and the students responded by reading and moving their names on the SMART Board. Following the completion of the graph, student names were counted, numerals were printed to represent quantities, and quantities were compared to align with Mathematics curricular outcomes.

Danielle's students also used shared writing to compose and print a morning message on a SMART Notebook slide (see Figure 8). The morning message was included daily to strengthen the following skills: i) generating ideas for writing; ii) composing a message; iii) counting words, segmenting words into phonemes, and representing phonemes with graphemes; iv) letter formation; v) concepts of print such as where to begin, spaces between words, return sweep; vi) punctuation; and vii) shared reading. SMART Notebook software allowed for student reversals and spacing issues to be easily fixed. Buttons at the bottom of the slide were hyperlinked activities to practice a different literacy skill for each day of the week following morning message: Mondays were oral sharing time, Tuesdays were syllable segmentation, Wednesdays were rhyming practice, Thursdays were phoneme segmentation, and on Fridays the students

watched an online phonics video on YouTube. Hyperlinked activities allowed Danielle to plan and prepare her literacy lessons for the week ahead and integrate them seamlessly into calendar activities.

Figure 8

Morning Message Slide from Danielle's Daily Calendar



Danielle also used her SMART Board, teacher computer, and the Internet to access web-based resources. The two sites that she visited most frequently were [Epic](#) on a weekly basis and [YouTube](#) on a daily basis. Both web and app-based, Epic is a free digital literacy platform where students can read and listen to thousands of books. When used as a whole class, Danielle accessed Epic's resources for Science and Social Studies content and to reinforce literacy skills. School closures occurred in the spring of 2020 at a critical time for Grade 1 literacy learning, and Danielle used Epic to continue guided reading lessons and individual student practice during this time. She assigned levelled books to her learners and screen-shared Epic books during synchronous video calls. Danielle reported that this worked much better than she expected and allowed her to follow the same steps as an in-person guided reading lesson. Her students were

able to follow along as she discussed different concepts and textual features as they read the book together.

YouTube was used daily to activate students' prior knowledge, review previous concepts, enhance engagement, and support curriculum implementation. Danielle shared that YouTube videos were used to review Mathematics concepts during calendar time such as days of the week, months of the year, and counting. She noted that the content on YouTube was also beneficial for phonics skills and mentioned that [Dr. Jean and Friends](#) was a favourite channel. Danielle commented that finding useful channels and managing lengthy and sometimes inappropriate advertisements were the most challenging aspects of integrating YouTube in the classroom. Purposeful integration of technology and safe, appropriate student use informed Danielle's decisions about how and when to include technology in her classroom.

Initial Analysis of Vignette. Danielle used the SMART Board, teacher-created materials, and websites to deliver the curriculum and develop skills. A significant portion of Danielle's school day included SMART Board use, and this may be best explained by the combination of Danielle's own interest, pedagogical beliefs, confidence, competence, and ready access to technology (Aubrey & Dahl, 2014; Burke et al., 2018). Although Danielle described her pedagogical beliefs as midway between student and teacher led, her confidence, competence, and strong belief in the value of technology may moderate the effect of her slightly more traditional beliefs (Cheng et al., 2022). Danielle's use of the SMART Board was teacher-directed, yet the locus of control was transferred to students during calendar activities when they were given opportunities to complete the activities by printing and manipulating objects and calling on their peers. As Danielle's students led whole-class calendar activities, leadership was fluid between Danielle and her students. The amount of support she provided was dependent on the needs of

the child, and she was able to step in with guidance to allow students to function within their zones of proximal development (Vygotsky, 1978).

Based on the information shared, it seemed that Danielle's integration of SMART Board technology was pedagogically purposeful and used to deliver the curriculum, develop important skills (literacy, numeracy, and ICT), and engage her learners in a whole class setting. This intentional use of SMART Notebook technology, YouTube, and Epic positioned her as a thoughtful designer of her students' learning environment (New London Group, 1996). Both Danielle and her learners had opportunities to interact and share ideas through multiple modes of communication due to the affordances of the technology that had been deliberately selected and integrated.

Reflections on Danielle's Classroom Practice. Danielle's confidence, competence, and access to technology were important factors that shaped her technology integration practices. Hall (2008) suggested that teachers' own experiences and skills in using digital technologies shaped how their students used technology, and this appeared accurate in Danielle's case. Danielle was a skilled and confident user of technology who used technology for specific purposes in her personal and professional lives. In her classroom, she guided her students to become skilled and confident users of technology who connected and communicated while becoming literate and numerate. Her use of technology was structured, orderly, and deliberate, but enabled space for student choice and agency.

The pandemic caused Danielle to adjust her classroom environment and her integration of technology. The touch surfaces of iPads and the SMART Board required sanitizing and student application of hand sanitizer before use which detracted from instructional time. Seesaw shifted from a learning portfolio and communication tool to a learning management system where work

was assigned, submitted, and given feedback. Given the young age of her students, Danielle was sometimes uncertain as to who completed the work when students were at home in isolation. During remote teaching, Danielle relied on digital books and the Zoom video conferencing platform to teach reading, which was something she never considered prior to the pandemic.

Danielle's teaching practice and context appeared to be consistent with a previous study (Francom, 2016) that investigated barriers in large and small school districts. Francom (2016) found that teachers with class sizes under 20 students in small school districts reported better access to technology tools than their counterparts in large school districts. In my next vignette, I share snapshots of practice from one of Danielle's colleagues from the same school division.

Teacher #2, Rural: Heidi

Heidi was an experienced educator with twenty years of rural and northern Manitoba teaching experience. Apart from teaching adult education classes, she had taught exclusively in the early primary years from Kindergarten-Grade 4. At the time of data collection, she was teaching a class of 11 Grade 2 students at Shoal Lake School in Park West School Division. Her teaching responsibilities also included Grades 1-4 French.

As a rural teacher in Park West School Division, Heidi enjoyed strong technology access and the support of the division technology integration coach. This coach was available to teachers by appointment for mentoring, co-teaching, professional learning, and equipment loan (such as robotics). In her Grade 2 classroom, Heidi's students used six iPads and Heidi had her own teacher iPad, laptop, and Chromebook. Heidi's classroom shared one-to-one Chromebook devices with two other classrooms, which meant they were not always available and required booking in advance. In a regular year, Heidi's 11 students could easily share the classroom iPads by working with partners. However, pandemic regulations prevented device sharing and close

physical proximity which presented a barrier to technology integration. Heidi did not have an interactive whiteboard; instead, she was provided with a large-screen television. Using Google Chromecast or an Apple TV, she could display her Chromebook, laptop, and iPad on the screen.

Heidi was a confident user of technology who described herself as always looking for new ways to use technology in her classroom. In her personal life, she relied on technology for texting, email, social media, scrapbooking, reading books, streaming television, playing online games, and staying current with world events. Heidi had a private classroom Twitter account for sharing her practice and connecting with other teachers, classrooms, and authors during The Global Read Aloud and I Love to Read Month.

Heidi explained that her pedagogical beliefs were grounded in teacher-led approaches, and she preferred a structured classroom environment with some choice available to students. She related that she needed structure herself and found that her students functioned better with routine and consistent expectations. Heidi shared that her practice had been influenced by the Daily 5 (Boushey & Moser, 2006) literacy framework and the guidance of Park West's technology coach and Manitoba Education's Mathematics consultant who provided suggestions for math games and teaching strategies. She believed that her role as a teacher was to provide support, to be there in any capacity for children, and to help them grow and learn in today's world. Classroom instruction was guided by the curriculum and specific calendar events (e.g., 100th Day of School) which Heidi referred to as theme based.

Heidi stated that by integrating technology regularly, her students developed literacy, numeracy, and technology skills as well as an understanding of safe and appropriate use. She felt that her students were most engaged and willing to take risks when the learning activities included technology. During coding activities, Heidi observed increased engagement and

independence as students worked to solve problems and succeed on their own. In the following vignette, I describe how Heidi introduced coding activities and made them part of her Grade 2 students' learning throughout the school year.

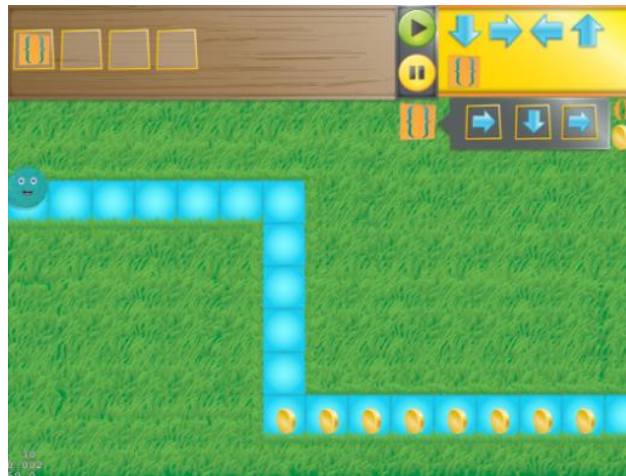
Vignette #2a: Coding with Grade 2 Students. Heidi had integrated a form of computer programming known as coding into her classroom practice for the past four years. The coding activities used with young children are typically categorized as block-based programming environments that rely on dragging, dropping, and sometimes snapping together program chunks (Kraleva et al., 2019). The real source code remains hidden, allowing young children to manipulate coding blocks to build and run their own programs. Usually, children drag and drop these coding blocks to provide instructions to complete a coding challenge. These coding challenges may involve guiding a character or robot through a maze or obstacle course, moving a character or robot in certain ways, or creating a scene, story, or game. All the coding apps and websites that Heidi used with her young learners fall under this classification.

Heidi coded as a child using BASIC, a simple computer programming language, on her family's Commodore 64 computer and really enjoyed the experience. Four years ago, Heidi was inspired to bring coding into her classroom practice after attending a colleague's coding event with her students during Computer Science Education Week. After being exposed to some of the coding tools designed for young children, she observed that her students enjoyed it as much as she used to as a child. Heidi decided to make it a regular part of her Grade 2 program with a weekly Mathematics class dedicated to coding and the option for students to choose coding activities during choice time. She estimated that most students spent an average of 60 minutes per week coding.

Heidi selected coding apps and websites based on their ease of use for young children and chose [Kodable](#), [ScratchJr](#), [Tynker](#), [codeSpark Academy](#), and [Code.org](#) to use in her classroom. Heidi related that her students gravitated towards Kodable as it was very straightforward and easy to use. She had observed that her students were very creative using ScratchJr with its capability to design interactive stories and games. Tynker was their least favourite coding tool as options were limited within this app as the school did not pay for a subscription. Heidi's students could access some of the coding tools on both iPads and Chromebooks, but she preferred iPads for coding activities because of the touchscreen functionality.

Figure 9

Kodable App Favoured by Heidi's Grade 2 Students



Note. The round character, Fuzz, is guided through the maze and collects coins using the arrows in the upper right of the screen. These arrows program or code Fuzz's movements.

Based on the model of her colleague, Heidi and her students hosted a Code-a-thon every December for Computer of Science Education Week and [Hour of Code](#)⁵. Heidi's students became experts on four coding apps, set up coding stations, and invited other classes in the school to cycle through the stations and learn more about coding. However, this was not possible during the pandemic as students could not leave their classroom cohorts and interact with other students. When asked how she first introduced coding in her classroom each year, Heidi explained that pre-teaching was minimal and that children were given time to explore the tools on their own.

Devon: I know that it's probably changed since the pandemic--why don't you tell me about this year, and then a typical year, how you prepare and get set up for coding in your Grade 2 classroom?

Heidi: Well, it's still pretty similar because I always introduce it the same way that I do with my Daily 5 (literacy program). So, we start out with an anchor chart of what it looks like and what it sounds like when we're using technology. We're working quietly, how we use the electronics, we go through all those different things and brainstorm. And then I go through the apps on my iPad and show them that these are the different apps that they can use while they're at the technology station. I airplay the apps to the TV so everyone can see and we sort of run through them and give them a little try. And then we'll spend a few days trying the different apps.

⁵ Hour of Code (*Join the Largest Learning Event in History*, 2022) is a grassroots movement with the goal of exposing as many people as possible to coding by engaging them in one hour of coding activities. Hour of Code activities and materials are free and available all year, but the official event is held in conjunction with Computer Science Education Week in December.

Devon: And this would probably be a pre-COVID thing...did your students code in partners? Or do they always code individually? What does that look like?

Heidi: They usually code individually. Pre-COVID there was a lot more helping each other out. Like, how do I do this one? Well, I would say, go ask this person, they've already done it. So, then they would come over and give them help and tips. But of course, this year we can't do that. So, it's more well, read the instructions. See if you can figure it out. It's more me and my EA (educational assistant) helping them out a bit more.

Devon: And normally, would there be an area in the room where they do coding, or do they go and get a device and then bring it back to their desk or table spot?

Heidi: Actually, well, this is the first year that we've had one-to-one Chromebooks. Up until this year, we've had a computer lab and we've gone down to the computer lab to do it. At the end of the last school year, they got rid of all the computers and gave us all Chromebooks. So, this is our first year doing it in the classroom. They work at their desk with either an iPad or Chromebook because we have to stay at our desks.

Devon: Does it require a lot of preparation on your end before you begin coding each year in your classroom?

Heidi: Yeah, to set up the classes and get everybody entered in takes some time. Some of the apps they can just use without a username, but most of them need usernames.

Transcript: March 16, 2021

Heidi shared that the division technology coach usually visited her classroom when coding is introduced to lead some unplugged coding activities. Unplugged coding involves any activity in which students are not using a device to engage in the different aspects of coding. These include working with paper and pencil or physical manipulatives to gain an understanding

of important coding concepts (*CS Fundamentals Unplugged*, 2022). The technology coach also brought robotics tools for Heidi's students. Using an app, they practiced coding the robots to make them perform different functions and move around a hundred chart or an obstacle course.

In one of our interviews, Heidi discussed how coding activities are important in primary classrooms as she believed that they strengthen 21st century skills such as critical thinking, problem-solving skills, and computer skills. She described the connections to the Mathematics and ELA curricula which supported her decision to include coding in her weekly schedule and dedicate Mathematics class time to this practice. She also viewed coding and Computer Science as an important career option and wanted to expose her learners to it at a young age. Heidi noted that the students demonstrated independence and persistence in coding activities and that they looked forward to engaging in coding. Additionally, she observed that it was not always the academically strongest students who enjoyed coding the most or experienced the greatest success.

Initial Analysis of Vignette. Heidi had made computer Science a regular part of her classroom practice for purposes of engagement and skill development. Heidi believed that coding developed 21st century skills such as critical thinking and problem-solving skills while fostering persistence, and current research supported these beliefs. Bers (2020) described coding as a new literacy that was appropriate for young children and fostered fun, play, and creativity, while developing perseverance, collaboration, and communication skills. This view of coding as another literacy was consistent with multiliteracies (New London Group, 1996) as it also created opportunities for children's sensemaking, self-expression, problem solving, and thinking in new ways (Bers, 2019). Drawing from the popular economy-driven discourse surrounding Computer Science (Mertala, 2021), Heidi expressed that children need to be exposed to coding at a young

age as a potential career path. This view was substantiated in the literature (Bers, 2020) as well as by the steady demand and predicted labour shortages for computer programmers (*Government of Canada Job Bank*, 2023).

Several years ago, Heidi was inspired to introduce coding by a colleague's coding event. At the time of data collection, that same colleague functioned as the technology coach who provided support and guidance to Heidi and her learners. The mentorship of the technology coach may be described as assisted performance (Rogoff, 1990) that enabled Heidi and her students to access help to engage successfully in coding instruction and tasks. The technology coach provided scaffolding to both Heidi and her students so they could function within their zones of proximal development to become independent in the teaching and learning of coding. Heidi's own role was similar when introducing and supporting new coding tools in the classroom. She provided an introductory overview and guided practice with adults in the role of more knowledgeable others (Vygotsky, 1978). Due to children coding in isolation rather than collaboratively with a peer, the social construction of knowledge was limited to whole-class learning, discussion, and adult assistance.

With her consistent integration of coding tools and yearly Code-a-thon, Heidi's classroom practice may be described as a pocket of innovative technology integration as these practices are not widespread (Nantais et al., 2021). In the next vignette, I share an account of Heidi's yearly participation in a collaborative global literacy event.

Vignette #2b: The Global Read Aloud and Classroom Collaboration. At the time of data collection, Heidi had participated in The Global Read Aloud for five years. "One book to connect the world" (Ripp, 2019a) is the premise of this ongoing global project developed in 2010 by teacher Pernille Ripp. With thousands of participants each year, this free project uses a

website, blog, and Facebook groups to connect teachers and students as they read the same books at the same time. Three authors are usually selected for three categories: picture books, early chapter books, and young adult chapter books. In recent years, there has been a strong focus on books that highlight diversity and promote conversation about important topics such as residential schools, immigration, and gender equality (Ripp, 2019b). The actual collaborative project takes place in the month of October, and Ripp provides a weekly schedule for books or chapters to read. The rest of the project is self-directed by teachers, allowing for variation in how teachers and students engage with the text and other classrooms (Carpenter & Justice, 2017).

In August 2020, Heidi posted in The Global Read Aloud Picture Book Study group on Facebook (see Figure 10). A Facebook group was created for each category of books, and they were popular places for teachers from around the world to connect and link their classrooms. At the time of this study, the picture book study group had over 4000 teachers in it and functioned as a hub for forming connections and sharing book activities. From her post in the group, Heidi had several offers to connect and decided to partner with a teacher and her Grade 2 classroom from Battle River School Division in Camrose, Alberta, Canada. Heidi cited time zone, grade level, and access to the same platforms as factors in selecting a partner classroom.

Figure 10

Heidi's Post in The Global Read Aloud Picture Book Study Facebook Group

Grade 2 class in Shoal Lake, MB Canada looking for a class to partner with.

6 comments

An attractive feature of The Global Read Aloud is the multiple entry points for technology integration. Teachers can simply read the books to their students and engage in

discussion or follow-up activities without the use of technology. Depending on educator comfort level, teachers may connect with one or more partner classrooms with multiple technology tools and a variety of activities. In 2020, Heidi connected with one partner classroom in Alberta and extended this connection throughout the school year. The following table provides more information about the tools she used during their collaboration.

Table 2

Heidi's Technology Tools and their uses during the Global Read Aloud

Tool	Description of Use	Comments
Google Meet	-used for video calls with their partner classroom -during these video calls, they introduced themselves, read The Global Read Aloud books together, and discussed the books	-addressed Manitoba English Language Arts curricular outcomes -Heidi's school division used Google products, so this was the most accessible video calling platform for her -in the past, she had also used Microsoft Skype
Twitter (now known as X)	-Heidi used her classroom Twitter account to connect with partner classrooms, authors, and to participate in Twitter discussions about the books	-social media platform -Twitter discussions on the books may be synchronous and asynchronous
Microsoft Flip (formerly Flipgrid)	-used after The Global Read Aloud during I Love to Read Month in February to extend the collaboration -students in both classrooms posted videos of themselves reading favourite books aloud -students listened to and commented on each other's books	-addressed Manitoba ELA curricular outcomes - Flip is a web and app-based tool where teachers can create collaborative groups and post topics or prompts for students -students respond asynchronously using video, audio, or text messages
ChatterPix Kids	-used to reflect on the stories and make connections to their own lives -students photographed a character from the book, drew a line for the mouth, and recorded their own voice sharing their thoughts based on a teacher prompt	-addressed Manitoba ELA curricular outcomes - ChatterPix Kids is a simple and free photo/video app created by Duck Duck Moose

Tool	Description of Use	Comments
	-saved as a video, these were uploaded to the classroom Seesaw blog -view a student work sample here	
Tool Seesaw	Description of Use -used as a space for students to create and share based on The Global Read Aloud books that were read -student work samples were published to the Seesaw classroom blog. This allowed their partner classroom to view and comment on the students' work. -in this sample , students reflected on their strengths and introduced themselves to their partner classroom	Comments -Heidi posted the activity with a template in each student's learning journal -completed learning activities were added to the integrated Seesaw blog by Heidi -the partner classroom viewed and commented on the blog
Google Maps	-a collaborative Google Map was available to all participants to drop a pin to show their location -students could explore the location of other participants	-useful for addressing Social Studies outcomes
Padlet	-students used Padlet to learn more about each other's communities -Heidi and her collaborative partner posted questions and prompts about communities -students worked as a whole group to respond to the prompts and read the other classroom's responses	-useful for addressing Social Studies outcomes - Padlet is a collaborative online bulletin board where participants can share via text, image, video, music, files, and links
Email	-after The Global Read Aloud concluded, Heidi's students composed emails to each other to continue connecting.	-in Grade 2, Heidi's students did not have access to email yet. Heidi sent the emails from her own account. -students also wrote paper letters which were mailed via Canada Post

Heidi noticed changes in The Global Read Aloud in the 2020-2021 school year which she attributed to the pandemic and some educators teaching remotely depending on the situation in

their region. However, Heidi and her students found it to be a worthwhile, enjoyable experience. In the following interview excerpt, Heidi shared why she continued to participate every year.

Devon: Why do you choose to participate in The Global Read Aloud?

Heidi: Ah, because it's fun to connect with other teachers around the world. Last year, I connected with a teacher in the States and it was a big football community. And it's interesting because their Thanksgiving is different than ours. So, we have that discussion because we always have that break for Thanksgiving right in the middle (of The Global Read Aloud) and it makes it hard. And so, we have that discussion about why our Thanksgivings are different. And there were times when they had their football stuff on and we're like, oh, yeah, we're not really into football up here. And then if we get a partner class from somewhere that's a little bit more south, we can talk about, oh, well, it's minus 20 degrees here. We try to tell them what that is for them in Fahrenheit and the difference between Fahrenheit and Celsius. They always want to hear about the snow, so we'll explain what a snow day is. I just find that we can have a lot of interesting discussions when we partner with an American classroom.

Devon: Yeah, just appreciating some of those differences between our countries. Would you say that you participate in the The Global Read Aloud because it's engaging for you as a teacher?

Heidi: Oh yeah and it's also very engaging for my students.

Transcript: June 16, 2021

Initial Analysis of Vignette. Through her participation in The Global Read Aloud, Heidi integrated technology to connect and collaborate with another classroom while meeting English Language Arts and Social Studies curricular outcomes. Heidi and her students participated in

The Global Read Aloud every year, and she described their experiences as very positive. This was consistent with a 2017 study of the project that found that 98% of participating teachers were overwhelmingly positive about the experience (Carpenter & Justice, 2017). According to an online survey distributed to all participants, most teachers used similar tools to Heidi such as Twitter, Padlet, video calling platforms, and emails, with 79% of participants taking part in at least one video call (Carpenter & Justice, 2017). The combination of synchronous and asynchronous collaborative activities in Heidi's classroom was also typical of most participants included in the study (Carpenter & Justice, 2017).

Heidi commented on the value of using digital tools to learn with and from classrooms in different geographic regions. The enriched literacy teaching and learning fostered by The Global Read Aloud provided both multicultural and multimodal collaboration (Carpenter & Justice, 2017). Heidi's students strengthened emerging literacy skills while learning about different types of communities through multiple modes: i) video (Google Meet, Flip, ChatterPix Kids, Seesaw); ii) linguistic (books, Padlet, Twitter, emails, letters); and iii) visual (books, Google Maps). The type of learning associated with The Global Read Aloud often requires teachers to move their students beyond consuming content to creating and communicating content with an authentic audience (Kerkhoff et al., 2022). This movement to creation and enhanced communication was evident in the products created by Heidi's students such as the [ChatterPix Kids](#) and [Seesaw videos](#). Heidi and her students had opportunities for global connectedness through their involvement in The Global Read Aloud. Students were exposed to different dialects, registers, discourses, visual and iconic meanings, and code switching which developed language skills (New London Group, 1996).

Heidi reported enhanced teacher and student engagement during The Global Read Aloud. This may be attributed to having an authentic audience, connecting with people in another region, or using fun and interesting technology tools in place of paper and pencil activities (Kerkhoff et al., 2022). By connecting with knowledgeable others in these online spaces and using technology in the classroom, Heidi and her students had meaningful opportunities to engage in rich collaborative learning experiences that exemplified the key aspects of sociocultural learning (Polly et al., 2018).

Reflections on Heidi's Classroom Practice. The vignettes of Heidi's classroom showcased her integration of technology to develop 21st century skills and meet curricular outcomes through coding activities and The Global Read Aloud. A desire to increase engagement for her students and herself was also rooted in her technology-supported practices. Heidi was an educator who described herself as having a structured and teacher-led approach to learning. In the research, these traditional pedagogical beliefs have been associated with ineffective or limited technology integration (e.g., Ertmer & Ottenbreit-Leftwich, 2010; Hsu, 2016; Kim et al., 2013; Tondeur, 2020). However, Heidi integrated technology daily, taught coding, and used collaborative technology tools to participate in The Global Read Aloud. She was a reasonably confident and competent user who valued educational technology highly. The findings of Cheng et al. (2020) provided a lens to examine Heidi's practice. They found that traditional teacher-centred pedagogical beliefs were mitigated by factors such as teacher competence and the perceived value of technology. The negative impact of traditional pedagogical beliefs was nullified when teachers valued technology and felt competent in their ability to use it. In fact, the researchers discovered that when competence beliefs were extremely

high (two standard deviations above the mean), the impact of traditional pedagogical beliefs became positive.

Additionally, Heidi taught in a well-resourced classroom and school division. She had strong Internet connectivity and access to a range of technology devices. In an Australian study, Burke et al. (2018) found that the strongest determinant of teacher technology use was available technology tools and immediate access. This applied to Heidi's situation with her classroom iPads and ability to project via Chromecast or AppleTV to her classroom television.

Finally, as in all classrooms at this time, the pandemic caused shifts in Heidi's teaching practice. During the time of this study, Heidi did not teach remotely. However, the need for social distancing changed how she used technology with her students. For example, in previous years, when Heidi's students engaged in coding activities, she directed them to draw on the expertise of their peers when they encountered an obstacle. During the pandemic, the number of more knowledgeable others was reduced to Heidi and her educational assistant. In the past, students would have shared iPads and taken turns or worked collaboratively. At the time of this study, students were required to use a device in isolation at their desks. This hampered the social construction of knowledge in her classroom.

Summary

In this chapter, I shared the results from the online survey through narrative description, charts, and graphs. To provide context and examples from teacher practice, the quantitative data were followed by vignettes of the two rural teachers, Danielle and Heidi. These vignettes included a description of the rural teacher, excerpts from interviews with the teacher, student work samples created with technology, my analysis of the teachers' technology use, and my reflections that connected the teachers' practice to the literature and theoretical framework.

These vignettes provided insight into the research questions that queried how teachers integrated technology, their purposes for doing so, and the pandemic-related shifts to teacher practice.

Danielle's vignettes highlighted how she integrated technology to foster connection, build community, teach the curriculum, and develop important literacy and numeracy skills. Heidi's vignettes featured her use of technology to participate in The Global Read Aloud, to teach and practice coding, and to develop computational thinking skills. These vignettes showcased both educators' teacher-led beliefs and practices as they described integrating technology to meet curricular outcomes, develop skills, and maintain an organized and structured classroom. In the following chapter, I provide vignettes of the two urban teachers, Arielle and Geneviève.

Chapter 5: Qualitative Data from the Multiple-Case Study

In this chapter, I continue to share the qualitative data through a second pair of vignettes that depict the typical technology-supported teaching practices of the urban teachers, Arielle and Geneviève. Structured in a similar fashion, the reader may expect: i) a description of the teacher; ii) excerpts from conversations with the teacher; iii) work sample(s) created with technology from the teacher's practice; iv) my analysis and reflection on the teachers' purposes for integrating technology, and v) connections to the literature and the theoretical frameworks that support my research.

Vignettes of Urban Teachers' Technology-Supported Practices

Teacher #3, Urban: Arielle

During the time of data collection, Arielle was teaching 22 children in a French Immersion Grades 1 and 2 classroom at École Constable Finney School in the Seven Oaks School Division in Winnipeg. Many of Arielle's students came from Filipino and Indian families who had migrated to Canada in recent years. Arielle expressed interest in participating in this research as she felt that technology use with young children was an understudied field. She was also eager to promote technology integration and hoped to inspire other teachers by sharing her classroom practice through this research.

At the time of the study, Arielle had taught for eight years and described her pedagogical beliefs and practice as student-centred. She believed that students learned best in a community of learners (Brown & Campione, 1994) engaged in play, storytelling, and inquiry-based and project-based learning. The work of Paley, an advocate for play-based learning, and the Reggio Emilia approach were cited by Arielle as significant influences on her beliefs and practices as an

educator. The following excerpts from our first and second interviews provided insight into Arielle's pedagogical beliefs and how she viewed herself as an educator.

Devon: Arielle, how would you describe your role as a teacher in your classroom?

Arielle: My role as a teacher in the classroom is very much a co-learner. I'm a listener. I'm a cheerleader. I'm a supporter, I'm a helper of zippers and buttons, and tying shoelaces. I'm sometimes the mom, I'm the Band-Aid getter. I'm the hug giver. I'm the person that hears an idea and finds resources to support growth and learning in the classroom. I'm a friend facilitator, that too, so I'm just kind of an all-around support system for the kids.

Devon: How do you believe that students learn best?

Arielle: I think they learn best in a community of learners. I think they learn best in a multi-age classroom, and I might be biased. I think that learners learn best when there's a sense of belonging, a sense of ease when they're not stressed, when they are given the time to process things. Children learn best when they feel supported and feel like, "I can do this". I think they learn best in a project-based setting where it's not so much skills and drills, it's coming up with ideas for projects, and then building in those skills that they need to move the project forward. So, the kids have a direct purpose as to why they're learning what they're learning, because they really want to be able to target that task or complete that part of the project. The children come to know that they need to learn a bit more about such and such or they need this skill to do that. So, I think project-based learning or inquiry-based learning is incredibly rewarding for children. And along with project-based learning, children learn best by doing and playing out their ideas.

Transcript: January 11, 2021

Arielle had an interactive whiteboard, one computer for teacher use, one classroom iPad, and her personal iPhone to support technology-based learning. She described her attitude to technology as very positive, relating few negative aspects to technology use other than her limited access to technology. She believed in using technology intentionally to foster community, honour children and their interests, document learning, build knowledge through research, and enhance accessibility for all learners.

Arielle relied significantly on technology to expand the children's world beyond the four walls of the classroom and the school's resources. One way that Arielle integrated technology was to access multimedia and human resources to answer students' questions and construct new knowledge. Arielle's students used the iPad to access sites such as the Smithsonian and National Geographic as well as aquariums and museums. Arielle had also used technology to engage in video calls with experts such as a scientist from Ocean Fisheries Canada. She marvelled at the equalizing power of technology that allows children on the prairies to learn so deeply and richly about ocean animals. In the next vignette, Arielle described how she and her learners constructed and shared knowledge about ocean animals using technology.

Vignette #3a: Inquiry-Based Learning and Knowledge Sharing with Movie-Making.

One of Arielle's primary purposes for technology integration was to support inquiry and project-based learning. She implemented these preferred pedagogical approaches in her multi-age classroom, and she began each school year with a whole-class inquiry project to teach the children the inquiry process. Once the children participated in a whole-group project, they embarked on individual or small-group inquiry projects on the same theme. For example, the theme for the entire school year was ocean animals. The following vignette outlines how Arielle started with a whole-class project on beluga whales. Following the beluga project, the children

had the opportunity to choose any sea creature that interested them for an individual or small-group project. Throughout the vignette, it was apparent that technology was not the focus of any of the learning that took place in Arielle's classroom; instead, it was a collection of tools that operated in the background to support, enhance, document, and share the inquiry project. Many aspects of whole-class and small-group inquiry projects were uploaded to Seesaw as they occurred. This made it seamless for Arielle to show and celebrate student work by sharing it on the SMART Board as well as sharing it with families at home.

Arielle: Since our endangered species projects were cut short last school year because of the pandemic, I knew that many of the now Grade 2 children in my classroom were still really eager to continue to learn about their researched animal. So, I thought, what are we going to start with being in Manitoba? So, we started with belugas. And that was such a rich experience. And we, we learned so much, but the purpose of me telling you this is because the story that we made, we'd been doing a lot of shadow puppet play because it was COVID. And we could be at arm's distance with our popsicle sticks and our puppets. We did a lot of shadow puppet play. Throughout our inquiry, the children had learned that because of sea temperatures rising, orcas are moving into beluga whale territory in the Hudson's Bay and are targeting belugas who are already endangered or at risk in some areas, they're at risk in the St. Lawrence. So, the children knew that they were at risk in the St. Lawrence, they knew that they could potentially become at risk in the Hudson's Bay because orcas are now hunting them there. The children wanted to create a story to symbolize that. At the same time, we found out that in the Gulf of St. Lawrence, the shipping industry is making it really hard for pods of belugas to stay together, which is why a pod might be at risk, because they get separated, the moms and the babies get

separated and they can't find each other with their calls and then the babies die. That was another thing that we learned. And then the final thing that we learned was about a beluga. I don't remember what his name was, we named him in our story, Neo, he might have been named Neo, but now I can't remember. And he was a male beluga and males belugas travel individually, most of the time. Females travel in pods with their babies, and this male he had, they think it was like the equivalent of scoliosis and he had a very pronounced bump on his back, and he was vulnerable. So, he ended up being kind of adopted by a female pod in the Gulf of St. Lawrence. So, we learned all these stories throughout our research. And I like to use storytelling and technology as a culmination to share what we've learned throughout our project and as a way to publish it to a wider audience. Usually, it's just our school and our parents, but that's still a pretty sweet audience for grade ones and twos. Anyways, so we storyboarded this very interesting, elaborate story about a pod of belugas and a baby getting separated because they heard a loud boat horn and the baby couldn't find his mom plus, a pod of orcas that came to hunt them. Then Neo, the beluga with the bump on its back in our story arrives. It's fictional, obviously, but in our story, he sacrifices himself, because he's saving the baby that got lost from its mom, and then he dies, but the baby gets reunited his mother and his pod. While we were making this video, the children remembered a story we learned all the way back in the first term. In November, we studied a local war hero for Remembrance Day. He sacrificed himself when his plane was going down and in so doing saved his gunner. The children wanted Neo to sacrifice himself to save the baby beluga, just as our war hero had. I thought this was a special idea and a wonderful way to weave previous

themes into our group story. This was a group project--every child was involved in this story.

The children also made their own beluga sounds which we learned sort of what they're for, and they made their own music and recorded it to go with this and they wanted music that was--you'll see, it changes based on which whales you see on the screen. We filmed it with the classroom iPad.

View this work sample here: [L'histoire des Belugas](#)

Transcript: May 17, 2021

Initial Analysis of Vignette. This vignette showcased how Arielle integrated technology to honour children's interests through inquiry-based learning and enact her student-centred pedagogical beliefs. The components of multiliteracies theory (New London Group, 1996) were helpful tools to examine this final product of a rich inquiry-based learning process. Throughout that learning experience, Arielle accessed audio, visual, and text-based resources in both French and English to sustain students' inquiry and personal meaning-making through multiple modes. Arielle's use of shadow puppets was an innovative way for the students to tell the beluga whale story through gesture, but this instructional decision was made with another factor in mind. Shadow puppets attached to long sticks provided a way for students to work collaboratively while maintaining COVID-19 social distancing regulations (Government of Manitoba, 2021a).

While Arielle was passionate about using technology to support inquiry-based and project-based learning, she was equally invested in honouring children's right to play and develop and share their own stories. This process was further illustrated in the next vignette.

Vignette #3b: Play, Storytelling, and Technology. Arielle, her administrator, and her school division were committed to children's right to play throughout the pandemic. Arielle's

students wore masks and practiced good hand hygiene and continued to engage in collaborative play activities with some modifications. Play was foundational to Arielle's practice and was used as a springboard for literacy learning. In one of our interviews, Arielle summarized the play and storytelling process as follows: i) when large blocks of time are available in the day (45 minutes or more), the students participate in Storytelling Workshop; ii) begins with minimal structure with the Grade 2 students providing leadership to the Grade 1 students; iii) children have access to many different materials such as a dollhouse, animals, cars and trucks, a castle, Lego, large building blocks, strips of fabric, musical instruments, and puppets; iv) children develop the understanding that the play they are engaged in is a story; v) favourite play stories are revisited until they become a story with characters and a plot; vi) sometimes an individual child has an idea for a play story and asks friends to join the story; vii) friends may provide input to the person's story; viii) Arielle conferences with the children to develop a script and background music; and ix) after further practice, the story is filmed with the classroom iPad. In the following excerpt from an interview, Arielle shared more about these final stages.

Arielle: There's also a bunch of musical instruments. So sometimes the children are working on musical stories. Or sometimes they're using those instruments to add to a story that they've already filmed. So, they're making the background music for a story. And I'll have a mini storytelling conference with them about what sort of emotion are you trying to evoke in this story? And how can the music that you're writing and creating match the theme of the story?

Devon: Wow, creating their own musical scores for their stories is pretty impressive. Do you ever have students who struggle to just create a basic story?

Arielle: Sometimes a child finds it hard to begin a story. This year I had a little boy, and he was very young and pretty quiet and shy. But he found the castle and he went there for about two weeks. And then I kind of thought, oh, I think he needs a bit of support. His literacy experience wasn't as rich and diverse as some of the other children. He really needed help in how to create a beginning, middle and end of a story. So we went back to the basics, we read a bunch of stories, and we found the beginning, the middle, and the end, that was his reading workshop. So, his writing workshop was him having a first idea in the story, and then trying to play it out with the Playmobil in the castle, but then not really sure how it ended. So, he and the children that were around him playing, we all sat down, and we kind of mapped it out. So, I was the one that was documenting it in writing form in his writing notebook. And then we practiced it, I would be the narrator, we practiced it, they played it out over and over again. And then it was time to film.

So, anytime a group is ready, they'll say, "Hey, Madame, can we use the iPad today to film it?" Sometimes they don't remember that if they're all characters in the story, they actually don't have anybody to film their story. So, it often ends up being me filming their story because they don't have a videographer. I find it amusing that they also all want to film the story because they want to use the iPad, but it's like, well, then who's going to be the dog in the story, you know?

Devon: They must be so proud of their finished products.

Arielle: You have no idea. We have screenings, we have like, International Film Festival screenings right before lunch hour after Storytelling Workshop's over if there's a group that's done. I upload it into their Seesaw learning journals, and then I project it onto the SMART Board and oh, man, the energy is palpable.

Playmobile Castle Story: [Bad Guys in the Castle](#)

Transcript: May 17, 2021

Initial Analysis of Vignette. The previous vignette captured one of the many stories that had been developed through play and told through technology in Arielle's classroom. Arielle used a technology-supported storytelling curriculum to develop her students' literacy and French language skills in a play-based, developmentally-appropriate manner. This use of technology to strengthen literacy skills was also evident in the literature (e.g., Flewitt et al., 2015; Lu et al., 2017). In Arielle's classroom, her learners accessed digital information, wrote and practiced reading their own scripts, and narrated stories in both French and English. These stories were captured and shared in various ways that included the children as the actors and musical composers as well as stop-motion animation, puppets, or clay/plastic figures. Depending on the type of play that sparked the story, Arielle integrated a wide range of linguistic, communicative, and technology perspectives and tools to create learning experiences and products that were interdisciplinary, collaborative, and social (Gee, 2010; Jenkins, 2006). This integration of digital tools into children's play and storytelling extended possibilities for children and supported their cultural meaning-making (Palaiologou, 2016).

As described in Vygotsky's (1978) sociocultural theory, Arielle guided her learners in her role as the more knowledgeable other. When she identified a Grade 1 student who was struggling to develop his own play stories, she provided support to scaffold his play and exposed him to many stories with strong beginnings, middles, and endings. With this guided practice, the student was able to develop, film, and later read his story. During Storytelling Workshop, Arielle functioned as a guide who operated a step or two ahead of her students. Through observation, conferences, and questioning, she facilitated, extended, and deepened their learning.

Reflections on Arielle's Classroom Practice. Arielle integrated technology for many purposes, but her primary purposes for technology integration were to honour children and their interests, magnify children's voices, engage in community building, and foster a sense of belonging for children and their families. Arielle strived to be a responsive teacher and she leveraged technology to do so. Arielle relied on the vast multimedia resources of the Internet to support inquiry and project-based learning. Multiliteracies theory and pedagogy (New London Group, 1996) were apparent in how Arielle acted as a designer of student learning to integrate a variety of modes that foster meaning-making and communication. Created with the classroom iPad and iMovie, the movies developed by Arielle's students encompass linguistic, visual, and audio elements.

Arielle's student population came from diverse cultural backgrounds and she provided them with diverse modes to construct and share knowledge. The students' own words, in French or English, formed the narration of their play stories. The beluga shadow puppet movie was a rich example of visual and audio elements with the entire story depicted with shadow puppets and students performing the soundtrack and beluga whale sounds. Rowsell and Harwood (2015) investigated how children used iPads for creation and production to discover that children constructed knowledge in new ways, generated more diverse meanings, and shifted easily among communication modes. Arielle's students' play activities, collaborative inquiry-based learning, and rich multimedia productions also embodied the New London Group's (1996) pedagogical vision of the school as a site for media access, learning, collaboration, and creative involvement.

Although Arielle weaved technology throughout the children's learning, she experienced device access barriers (Ertmer, 1999) with her single classroom iPad. In many examples from the literature, lack of access to technology emerged as a determinant of teacher technology

integration (Aubrey & Dahl, 2014; Burke et al., 2018; Jack & Higgins, 2019). However, Arielle overcame this barrier which could be explained by her constructivist pedagogical beliefs, her skill level and interest (Miller, 2018), and her confidence and competence when using technology (Aubrey & Dahl, 2014; Ertmer & Ottenbreit-Leftwich, 2010).

Not only did Arielle function as the more knowledgeable other (Vygotsky, 1978) in her classroom, but so did students' peers. As described by Wertsch (1985), when participating in play, inquiry, and moviemaking, the learning in Arielle's classroom stemmed from interaction among individuals, groups, and cultural tools and artefacts. Students engaged in guided participation in shared activities to gain the knowledge, skills, and information they needed to convey their messages (Rogoff, 1990).

In both vignettes, the notion of constructivist, student-centred pedagogical beliefs leading to enhanced technology integration (Kim et al., 2013; Tondeur et al., 2017) was evident. Arielle's use of technology allowed her to enact these beliefs; technology integration for this purpose was described in studies conducted by Lu et al. (2017) and Heitink et al. (2016). Arielle related that although the pandemic was a significant obstacle to bringing people together and communicating in person, regular sharing of inquiry and storytelling projects through Seesaw allowed her families to feel engaged in their children's learning and feel a sense of belonging in the classroom community. In the next section, I share two vignettes of a second urban's teacher technology-supported practices that include remote teaching during the pandemic.


Teacher #4, Urban: Geneviève

During the time of data collection, Geneviève taught 14 children in a culturally-diverse French Immersion Grades 1 and 2 classroom at École Constable Finney School in Seven Oaks School Division. She was an experienced educator of 14 years who had taught Grades 1-4 in

both inner-city Winnipeg School Division and her current placement. Geneviève exhibited a positive attitude towards technology and described herself as a frequent and confident user of technology. She depended on her iPhone for many tasks and her entire home was set up as a Google smart home with speakers and devices in most rooms. She used the social media platforms Instagram and Twitter for professional purposes. For example, she relied on Twitter to connect with other educators to become involved in collaborative projects and to engage with authors to answer her students' questions and share feedback about books (see Figure 11).

Figure 11

Geneviève's Tweet to an Author

[@AmeDyckman](#) My grade 1/2 class would like to know if you are planning to write a third book about misunderstood shark! We love the first two books! Thanks! 

However, Geneviève's classroom access to technology was somewhat limited; she had a teacher computer, her personal phone, and access to a class set of Chromebooks three times per six-day cycle. Midway through the year, her interactive whiteboard was replaced with an interactive panel that offered significant improvements in functionality. Geneviève's interactive whiteboard/panel was often the hub of learning in the classroom. She shared that she and her students used it throughout the day to stay current on world events, conduct research for inquiry-based learning, and access French language songs, videos, and websites.

Geneviève described her pedagogical beliefs and teaching practices as more student-centred than teacher-centred, beginning with the children's interests and integrating outcomes from the provincial curriculum into their inquiries. She related that she saw herself as a guide and found that children learned best from inquiry-based approaches and from each other. In

addition to the children's interests and experiences, Geneviève's classroom practice was guided by a desire to develop kind, empathetic people through diversity and anti-racism education. In the following vignette, I describe Geneviève's technology-supported investigations and activities as she and her students examined the topic of diversity and anti-racism.

Vignette #4a: Diversity Education and Teacher Professional Learning with Twitter.

At the time of this study, Geneviève focused on identity, anti-racism, and diversity education in her Grades 1 and 2 classroom. Geneviève's learning activities were inquiry-based and stemmed from books, current events, and the children's own life experiences and observations. An early activity in her exploration of diversity was the creation of life-size paper versions of each student where they created custom skin colours by mixing paint and swabbing them on their skin to match (see Figure 12).

Figure 12

Geneviève's Classroom with Life-Size Student Paintings Shared on Instagram



Later in the school year, some of her students created protest signs which sparked an inquiry into why people protest and march as well as protest art. Unfortunately, this investigation was curtailed by a sudden move to remote learning. When asked about her passion for this area, Geneviève related the following experience.

Geneviève: I read somewhere that if children are young enough to experience racism, then they're young enough to learn about it. And I was thinking about that. And, you know, I'm a white teacher, and a lot of the kids in my class are either Filipino or Indian. And I have a broad spectrum. But I've never felt comfortable talking about certain things. And I was not sure about how to approach that with them. But then I was thinking back to my first year of teaching Grade 1, and one of the little girls had told us at morning meeting that she had been at Superstore the night before with her family, and they were speaking Punjabi, and a man came up to them and started screaming at them, "Speak English, you're in Canada, speak English." And she told us this during our sharing circle. And I remember saying to her, like, that's really not nice. That's not right. But we didn't go beyond that at that point in time, but it really got me thinking.

Transcript: March 16, 2021

Anti-racism education was prioritized by Geneviève's school division, and she approached these complex topics by reading books with her students about diversity, racism, and protest. Often, the content of the books sparked whole-class conversations that drew on the children's life experiences and questions, such as a transgender classmate, the farmer protests in India, and the Black Lives Matter movement. Geneviève shared that some of her students' families were from India, so a lot of the children knew about the farmer protests occurring there. They recounted conversations from their homes and used language such as *ally* to describe their parents' support of these protests. Another student in the classroom made a protest sign that read *Black Lives Matter* (see the following figures), and their classmates described them as an ally.

Figure 13

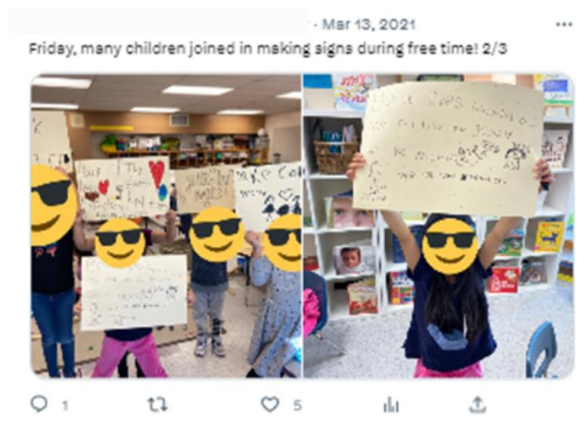
Geneviève's Twitter Post of Student Protest Signs



Note. Caption: Thursday, A made a sign during her free time then walked outside with it after dismissal.

Figure 14

Geneviève's Twitter Post of Student Protest Signs



Note. Caption: Friday, many children joined in making signs during free time.

Figure 15

Geneviève's Twitter Post of Student Protest Signs



Note. Caption: Looking forward to exploring these books next week! What a privilege it is to teach these wonderful children.

As Geneviève and her students explored the topic of diversity, technology supported their knowledge construction, social media use, and creation. For example, when the children made their life-size paintings, Geneviève and her students used SMART Notebook software to create a wonder wall of their questions and wonderings about skin colour and race. Geneviève also shared that technology and social media had been very useful in building her own understanding of these complex issues.

Geneviève: And I should mention that personally I use a lot of technology so I can talk to my students about these issues. I follow lots of people on Twitter and lots of different voices, especially making sure that I'm following different thoughts and different people who have different opinions about it. My Twitter feed is very diverse now. And I mean, I think it was pretty diverse before, but now I try to follow people who actually talk about

anti-racist education. So as a resource for me, I've used a lot of technology, especially Twitter, probably more technology than I've used with the kids.

Transcript: March 16, 2021

Initial Analysis of Vignette. This vignette was unique in that Geneviève's primary purpose for using technology was to support her own learning so that she could teach from a more informed position. Although she integrated some technology into her learning experiences on this topic, it was mainly for student inquiry and documentation of learning. In her role as a teacher, Geneviève viewed herself as a guide. To function as a more knowledgeable other and scaffold the learning of her students (Vygotsky, 1978), she relied on technology to build her own understanding of the complex issues surrounding diversity and race. In order to increase her own knowledge, Geneviève turned to social media and personalized her professional learning by following many diverse voices and perspectives. For example, Carpenter and Krutka (2015) found that teachers' use of Twitter for self-directed professional development was efficient, interactive, and readily available, and impacted classroom practice through increased classroom collaboration and enriched student experiences (Visser et al., 2014). Twitter's microblogging platform was leveraged by educators to gain and share inspiration, ideas, and information in a supportive community (Nochumson, 2020). In Geneviève's case, it seemed that her use of Twitter provided her with an online space for connecting equally with people of similar interests as well as those with diverse perspectives (Carpenter & Krutka, 2015).

In this vignette, Geneviève used technology to personalize her professional learning to respond more effectively to the interests and life experiences of her learners. The following vignette showcases how Geneviève leveraged technology to ensure learning continuity during a global pandemic.

Vignette #4b: Using Technology for Remote Teaching. This vignette describes the shift in Geneviève's classroom practice due to COVID-19, the technology she used, and the challenges she faced as she navigated a hybrid model of teaching. This hybrid model was implemented to teach high-risk/special needs students and children of critical service workers in person at the same time as children learning remotely from home.

In an earlier interview, Geneviève described how she had changed the physical layout of her classroom in response to pandemic regulations. Previously, her classroom had been influenced by the Reggio approach with different areas and shared materials for play and exploration. For the 2020-2021 school year, all the tables were moved to the centre of the room with remaining materials and furniture lining the walls. Plexiglass shields divided the round tables into quadrants and Geneviève wore a mask at all times.

Geneviève's experience with remote teaching in 2020 resulted in greater preparedness and increased capacity in her classroom. For example, she shared that in 2020, she used [Google Classroom](#) as her main platform and spent a significant amount of time creating videos and learning experiences. She estimated that only five children completed their work consistently, a fact that she attributed to the need for adult support for children to access and navigate Google Classroom. For the 2020-2021 school year, Geneviève knew advance preparation using a more child-friendly platform was required in the event of remote teaching. With the goal of developing student independence, she and her learners engaged in the following practices: i) using login cards to log into Chromebooks three times per week; ii) using Chromebooks to navigate the Seesaw platform; iii) completing activities in the Seesaw learning journal; iv) visiting the [SplashLearn](#) website to play Mathematics games; and v) using the [Epic](#) website to read and listen

to books. Geneviève noted that the Grade 2 students provided support to the Grade 1 students and that by Christmas 2020, most students demonstrated a level of comfort and independence.

Since Geneviève was solely responsible for teaching children remotely and in person, she made the instructional decision that in-person and online learners would receive the same program. This consisted of online synchronous instruction on [Microsoft Teams](#) and asynchronous learning activities that were both web and paper based. The paper-based materials were sent home every few weeks as learning packages. When it was time for synchronous instruction, the in-person learners took their Chromebooks to the hallway so that Geneviève could remove her mask to teach online. In this hybrid model of teaching, she relied mainly on Seesaw and Microsoft Teams for her in-person and remote learners. Seesaw has a large library of pre-made learning activities that Geneviève assigned in all subject areas. Other online tools that Geneviève integrated include [YouTube](#) videos for Science content and mindfulness, [SplashLearn](#) for Mathematics games, [Epic](#) (online books for children to read and listen to) for Science and Social Studies content, and [Je Lis](#) (a French language website for listening to and reading books). Geneviève described instruction in French as one of the most difficult obstacles of remote learning, as her students were too young to be fluent in the French language and most of their families cannot help them.

In addition to pedagogical challenges, Geneviève and her students also experienced problems with technology and device access. The main technological challenge was delayed and frozen video in Microsoft Teams; however, Geneviève's students became proficient with leaving and rejoining video calls to remedy the problem. Device access in homes with multiple children learning remotely was another issue, and Geneviève's students tried to share devices with siblings. However, device sharing was only possible if teachers of different grades worked

together to ensure that online lessons did not occur at the same time. During our interview, Geneviève explained that she was completely exhausted from teaching online, managing children in person, responding to parent messages, and approving and providing feedback on Seesaw assignments.

Devon: So, this a unique situation with the fact that you have children of essential workers in person in your classroom and then you're teaching kids remotely who are at home with their families. Tell me about how you have set this up and how you're managing it.

Geneviève: Seesaw is kind of our hub for everything, so, I have a link in Seesaw for our daily morning meetings through Microsoft Teams. It's pinned at the top of their journal. So, when they open it up, their parents really don't have to help them that much. I mean, I know a lot of their parents do, but they can open the app. They can click on the link, and they're in the meeting already. It's kind of like a one-stop place. Every day I post a schedule and I say what we're going to do during our morning meeting, and then what they can do for independent work and then other stuff that they can do.

So, it's been like almost 100% attendance at every meeting every morning, they're all there. And they're really cute and they're really participating for the most part. And then the thing is, I also have the in-class kids. So, I figured the easiest way for me was just to involve them in everything that the kids at home are doing. And I'd actually made everybody a learning package because really, it wasn't just like busy work. So, they do the same stuff. Like when they're working at school, they're working on the stuff that was in the learning package. And on the outside of the package, I listed clearly what was in there--it was like stuff for morning meetings. And then I made a sheet of all their

passwords, all the websites we use with the logins. And I laminated it so they all have that in one place. Last year, I think there was a lot of like, here's this website, and here's that one and, and I feel like that's not helpful for parents at all either. So, it's kind of tough--we were told that we wouldn't have to do both (in person and online teaching). But we are all doing both somehow, for this last remote learning.

So, the in-person learners participate in the morning meeting outside the classroom so I can take off my mask in front of the camera, they're in the hallway with Chromebooks. And then, last week, I was doing some reading with some Grade 1s because we're doing report cards. So, we're doing reading online, I was just using Raz-Kids (online site for reading levelled books) and then I project (screen share) it. And then they read it off the screen, which is awesome if they have a laptop, but one of the kids I was assessing Friday, she's doing it off the phone. And she's like Madame, the words are so small, can you make it bigger? And it was a gong show. But I mean, I got I got the gist of how she's doing.

Devon: That sounds really difficult for both of you. Can you give me an overview of your day so I have an idea of what this combined remote and in-person learning looks like?

Geneviève: So, school starts at 8:20-8:25, our meeting's at nine. So, usually, I get my in-class kids to go on Seesaw to work on the activities or anything that I've assigned just so they can get those done, because I take away the Chromebooks after recess because I don't want them on Chromebooks all day. And they would very well sit there and go on YouTube. So, they go on there when they arrive. Then they kind of stay on Seesaw after the meeting, and I try to meet with random kids that have stayed online after the meeting

with me. Then we have recess. And then after recess, we have 15 minutes. And then they have gym. So, in those 15 minutes, I try to get them to work on like something from the learning package. When they go to gym at 11:30 usually I read with somebody else at home that has logged back into the (Microsoft Teams) meeting, then they have music.

Transcript: May 30, 2021

Since Geneviève was teaching in a hybrid model in May and June 2021, she was faced with the additional challenge of year-end assessment for report cards and placement decisions. In the following conversation, Geneviève described the obstacles she encountered when assessing children's work.

Devon: Are you using the students' collection of work in Seesaw for assessment right now or are you using Seesaw more as a communication and learning management platform? How are you handling assessment?

Geneviève: I find that it would be hard to use Seesaw as an assessment tool because I don't know how much help they're getting from family at home. Like, some kids do something, and I'm like, hmm, you didn't do that. Like, I think it's the older brothers and sisters, and a 13-year-old might not realize that them doing it is wrong...like they don't know, oh, I'm going to coach this kid through it and a lot of them have a 13-year-old in charge of them at home right now. So, I can't really use it for assessment. I'm definitely going to note in their report card comments that they completed their Seesaw activities. But I find that all of it is hard to assess--even the paper worksheets I got back, like when I switched out learning packages. I can't really assess their stuff because I don't know how much work their parents did. Even when I was reading with some of my kids, trying to

see where they were at...one little boy, I could hear his sister and she was whispering the words, not always, but a couple of times she whispered the words.

Transcript: May 30, 2021

Initial Analysis of Vignette. In this vignette, Geneviève integrated technology to provide synchronous and asynchronous student learning and conduct year-end assessments. Geneviève used her experience with remote teaching to prepare her students and inform her planning decisions and selection of tools. The challenges that Geneviève sought to avoid were described in the emerging body of pandemic teaching research that detailed issues with inequitable technology access, Internet connectivity, and families feeling overwhelmed with the number of platforms and logins (Spadafora et al., 2022; Timmons et al., 2021). The challenges Geneviève experienced with accurate assessment were also reported by other Kindergarten-Grade 2 educators who also found it impossible to determine how much help children received from family members (Timmons et al., 2021).

Geneviève's schedule of synchronous morning meetings followed by individual meetings and asynchronous learning tasks was a common approach with several benefits for the children. By maintaining a whole-class social connection, children were able to learn with and from more knowledgeable others to share and construct knowledge (Vygotsky, 1978). Synchronous learning activities supported classroom relationships and social-emotional development while asynchronous delivery facilitated greater access to technology in homes with multiple children (Timmons et al., 2021). Seesaw is a platform that allows for both types of learning, and Geneviève chose this tool as it is user friendly and fosters independence. User friendliness was ranked as the most important criterion for Canadian educators when selecting a learning management system for remote teaching (Decoito & Estaiteyeh, 2022). The multimodal

affordances of Seesaw allowed Geneviève to upload videos of her reading books, tutorial videos, audio instructions and feedback, images, and links to outside resources such as Microsoft Teams, YouTube, and learning apps and games.

Geneviève used this multimodal platform in conjunction with paper-based learning activities. She provided a variety of ways for children to access content and communicate which was consistent with multiliteracies pedagogy and theory (New London Group, 1996). Geneviève also made efforts to scaffold instruction remotely by developing her own tutorial videos to guide children through various remote learning procedures. Despite the obstacles of remote teaching, Geneviève utilized levelled texts and apps and sites to personalize student learning and offer opportunities to function in students' zones of proximal development (Vygotsky, 1976).

Although she had the tools and infrastructure to teach in this hybrid model, she felt she did not have the support. Geneviève commented on her exhaustion and dismay with the demands placed on teachers and the compromised learning experience of students. Several Canadian and Manitoban studies identified key issues impacting the mental health of teachers during the pandemic. These included workload, student needs, and loss of personal connection, resulting in mental distress, exhaustion, and burnout (Canadian Teachers' Federation, 2022; Gadermann et al., 2021; Sokal, Babb et al., 2021; Sokal, Trudel, et al., 2021). Geneviève shared that she was coping but struggling with workload and her perceived powerlessness to meet student needs.

Reflections on Geneviève's Classroom Practice. The two vignettes I shared of Geneviève's practice were in stark contrast to one another. The first vignette presented a snapshot of an educator investigating complicated issues alongside her learners with the assistance of technology. The second portrayed a teacher's mandated integration of technology for remote learning in challenging times. This juxtaposition highlighted Geneviève's willingness

to leverage technology to sustain and enhance learning and respond to the needs of her students. The versatility of technology and the adaptability of Geneviève's practice were showcased equally in both examples as was the shift in her practice due to the pandemic.

Multiliteracies theory (New London Group, 1996) was evident in how Geneviève integrated a variety of modes to enhance meaning-making and communication in her culturally diverse student and family population. Geneviève's strong technology skills and pedagogical knowledge allowed her to create multimodal learning materials to support asynchronous learning activities. These multimodal resources were dynamic and ever-changing (New London Group, 1996) to reflect the current needs of her learners as they navigated this hybrid teaching model.

As Geneviève shared her classroom practice, the notion of constructivist, student-centred pedagogical beliefs leading to enhanced technology integration was apparent (e.g., Heitink et al., 2016; Kim et al., 2013; Tondeur et al., 2017). It appeared that even during the difficult days of the pandemic, Geneviève was a responsive teacher who honoured children's interests and questions to guide their learning.

Summary

In this chapter, I shared vignettes of the two urban teachers' technology integration practices. These vignettes addressed the research questions focusing on how and why teachers integrated technology as well as how technology-supported practices shifted during the pandemic. Arielle's vignettes provided insight into her use of technology for facilitating inquiry-based learning and storytelling workshop as well as for producing multimedia content with her students. In Geneviève's vignettes, her use of technology for self-directed professional learning to support anti-racism and diversity topics was described. While all the vignettes presented in Chapters 4 and 5 referred to pandemic teaching conditions, Geneviève's second vignette

documented her daily teaching activities during a hybrid teaching model and the role of technology in sustaining learning. When examined together, the student-centred beliefs and teaching practices of Arielle and Geneviève were strongly evident. Both teachers integrated technology to honour children's interests through child-centred pedagogical approaches such as inquiry-based learning and play.

In Chapter 6, the integration of the quantitative and qualitative data is achieved through a cross-case analysis. Using framework matrices, two overarching themes and four themes drawn from the qualitative data are linked to the quantitative data where relevant. Examples from the four teachers' classroom practices provide supporting evidence and rich examples of each theme.

Chapter 6: Integrating Quantitative and Qualitative Results in the Cross-Case Analysis

In the previous two chapters, the quantitative results from the survey have been presented as well as vignettes derived from the qualitative data of the participants' technology-supported classroom practices. In this chapter, the quantitative data are integrated with the qualitative data to provide further insight into the results. This is accomplished by including relevant quantitative information within the visual display of the cross-case analysis. In the cross-case analysis, I compare the four teachers' cases using tables for ease of interpretation.

Cross-Case Analysis

Although much can be gleaned from single cases, conducting a cross-case analysis enables the researcher to generate new understandings by examining knowledge of individual cases and comparing and contrasting them (Khan & Vanwynsberghe, 2008). Organization of the cases in visual displays assists the researcher in this comparison (Khan & Vanwynsberghe, 2008), facilitating investigation of the differences and similarities to increase understanding of the quintain (Stake, 2006). These visual displays also offer opportunities to connect the quantitative and qualitative data. By displaying the quantitative results alongside the qualitative findings, it is possible to interpret both forms of data jointly and determine how one increases understanding of the other (Creswell & Plano Clark, 2018). This section begins with a discussion of two overarching themes that are woven throughout the analysis. Following the exploration of the overarching themes, I present four additional themes that are more specific and address how and why the participating teachers integrated technology. Examples throughout the themes lend insight into the following: i) the shifts teachers made in their technology integration practices to navigate pandemic teaching conditions; and ii) similarities and differences in rural and urban teachers' technology integration practices, access to devices, and pedagogical beliefs.

Overarching Theme: Versatile and Powerful Tools and Platforms

While engaging with the data and exploring the creation of themes, it became clear that all participating teachers relied on a similar set of highly valued tools and platforms to accomplish many purposes in their practices. These versatile and powerful tools and platforms included: i) Seesaw (learning management and learning portfolio app/site); ii) individual student devices (iPads, Chromebooks, or both); and iii) an interactive whiteboard (such as a SMART Board) or projector display, most often used for whole-class learning. Obviously, the integration of Seesaw was largely dependent on access to the SMART Board, an iPad, a Chromebook, or the teacher's personal device. The combination of these three tools and platforms enabled teachers to plan and implement a plethora of multimodal technology-supported activities, including remote learning during COVID-19.

In the four participating teachers' classrooms, one device or tool performed many functions throughout the day. For example, in a typical day in Arielle's classroom, the SMART Board might be used for morning calendar, a math provocation, a video call to a scientist, and to share a student's progress with the whole class on an inquiry project as documented in Seesaw. In Danielle's classroom, an iPad might be used independently by a student to share a work sample in Seesaw, to access Epic for read to self during ELA (English Language Arts), and to practice addition on [Zorbit's Math Adventure](#). In a regular day in Heidi's classroom, Seesaw might be used to capture evidence of student learning, to send a message to all families about an upcoming hot lunch, and to collaborate with another classroom using Seesaw's blog feature. In Geneviève's classroom during pandemic hybrid teaching, in-class learners might have used Chromebooks to participate in a synchronous video call with students at home, to research how to build a butterfly habitat, and to complete a Mathematics activity in Seesaw. The four

participating teachers' use of these versatile and powerful tools was consistent with the quantitative data gathered from the survey. Frequent daily usage of an interactive whiteboard or projector was also reported by 61% of survey respondents, with 50% reporting daily use of iPad apps and 32% using Seesaw daily.

The themes that are presented later in this chapter include many references to these versatile and powerful tools that the participating teachers integrated throughout their practices. Although there is variation in teachers' individual purposes and uses, there is consistency in their reliance on Seesaw, interactive whiteboards or projection display, and iPads and/or Chromebooks. In addition to this overarching theme, a second overarching theme that applies across all cases involves digital literacy, technology skills, and the balance teachers attempted to attain as they integrated technology.

Overarching Theme: Striking a Balance and Developing Digital Competencies

This overarching theme explores the efforts of the four participating teachers to integrate technology effectively in their classrooms while maintaining a delicate balance. The theme focuses on the tensions between considering screentime and age-appropriate technology use while integrating technology for educational purposes. It highlights the participating teachers' emphasis on leveraging technology to develop digital skills for current and future student safety and success. The theme also underlines how the teachers prioritized active engagement over passive consumption when integrating technology in their classrooms.

Although this theme is not considered a primary purpose for integrating technology, it is present in all four teachers' technology-supported learning activities. For example, none of the participating teachers reported teaching lessons that focused on when or how to use technology safely nor did they integrate technology for the explicit purpose of developing digital skills.

Instead, these skills were fostered by teachers modelling and discussing with their students as they used technology in many ways in their classrooms. Despite the fact that none of the participating teachers referred to the document specifically, this overarching theme strongly reflects Manitoba Education's (2016) [Literacy with ICT Continuum](#). This online document provides a continuum that guides teachers to integrate technology in ways that support critical and creative thinking, health and safety, ethics and responsibility, and technology skills. Table 3 below provides specific examples of how teachers addressed these areas in their classrooms.

Table 3*Examples of Striking a Balance and Developing Digital Competencies*

Variable	Danielle	Heidi	Arielle	Geneviève	Survey Results
Developing important digital skills	Danielle's whole-class SMART Board use allowed students to build technology skills without having a lesson focused on technology skills. Through observation and modelling, her students learned how to save, exit a program, etc.	Stated that coding helped children develop persistence, risk-taking, problem-solving, and critical thinking skills while preparing them for careers in a digital future.	When Arielle's students encountered information online when researching, she guided them to evaluate the source, its trustworthiness, and the consistency with other resources.	Discussed how important it is to use technology in valuable ways (as opposed to glorified worksheets) to provide students with the opportunity to develop important digital skills.	Of the nine open-ended survey responses, one was coded <i>tech integration for future student success</i> and shared the teacher's belief that the world is technology-based and students need to learn to use these devices.
Finding balance: Screentime and active use	Stated that as much as she liked using technology, she tried to always be aware of how much screentime children were exposed to between classroom SMART Board and iPad use.	Discussed the importance of prioritizing active technology use (coding, creating) over passive technology use (watching videos, playing games).	Talked about the importance of children using technology to create and share knowledge to have an impact on the world around them.	Commented that while it was important to integrate technology, technology did not need to be used all the time and children did not need to be on a device constantly.	Of the nine open-ended survey responses, one was coded <i>balancing screentime</i> and reflected the teacher's position that young children have too much technology in their lives and screentime should be limited at school.

Theme #1: Technology to Enhance the Learning and Teaching Process

This theme is broad and encompasses many aspects of all four teachers' technology-supported activities. It addresses two of the main research questions with one big idea: first and foremost, teachers integrate technology to improve teaching and learning. These purposeful improvements to teaching and learning include: i) assessment practices and evidence of learning; ii) classroom routines, including daily calendar; iii) student engagement; iv) literacy, Mathematics, and content area instruction; v) access to resources; vi) personalization of learning, additional practice, and skill reinforcement; and vii) student independence.

The ways in which teachers integrated technology are also illuminated by this theme. Whole-class learning activities, such as daily calendar and instruction across subject areas, were generally accomplished through SMART Board use or projection of some sort. Personalization of learning, additional practice, and skill reinforcement were usually addressed through individual device use (iPads and Chromebooks). Student independence with technology was fostered through whole-class modelling on the SMART Board then reinforced through individual practice on an iPad or Chromebook. Technology integration for student engagement and access to resources spanned whole-class and individual platforms. When referring to engagement, it is interesting to consider that although many of these technology tools are not recent developments, the participating teachers consistently reported that they integrated technology because students found it engaging and motivating and so did they. Table 4 provides more insight into how the four teachers integrated technology to enhance teaching and learning.

Table 4*Technology to Enhance the Learning and Teaching Process*

Purpose	Danielle	Heidi	Arielle	Geneviève	Survey Results
Assessment and documentation /evidence of student learning	Used Seesaw as a learning portfolio to capture snapshots of student achievement across subject areas. Students used the audio recording feature to explain their learning.	Used Seesaw as a learning portfolio with work samples across subject areas to support summative assessment decisions.	Used Seesaw as a learning portfolio. Documented student inquiry projects in Seesaw by filming and photographing the stages in the project.	Used Seesaw as a learning portfolio that included recordings of students reading in French and explaining a math strategy that they used.	Seesaw was used daily by 32% of respondents and several times per week by 36%. With a range of daily to several times a month, 54% of respondents used technology for assessment.
Streamlined classroom routines and richer, more varied calendar activities	Attendance slide in SMART Notebook morning calendar to document attendance and practice language, literacy, and numeracy skills. Calendar activities were hyperlinked to different daily activities.	Used an iPad app for morning calendar (My Calendar) that included day, month, year, yesterday, today, tomorrow, weather, and season.	Daily math investigation displayed on SMART Board followed by morning routine that included calendar activities and hyperlinks to literacy, numeracy, and French language activities.	Daily morning routine on the SMART Board that included relaxing music/images as the students arrived followed by morning meeting and calendar. Calendar targeted a variety of skills including patterns.	Of the nine open-ended survey responses, one was coded <i>smartboard for predictable daily routines</i> .
To increase student engagement	Shared that her students were highly engaged in calendar activities	Shared that anything that involves technology was	Integrated technology to support student inquiry projects and	Related that her students were highly engaged in morning calendar	46% of survey respondents cited <i>increasing student engagement as their</i>

Purpose	Danielle	Heidi	Arielle	Geneviève	Survey Results
	on the SMART Board, especially when they were the special helper who led activities for the whole class.	very engaging for students. When they were coding, Heidi described her students as working independently and appearing very engaged.	reported that students were highly engaged in using the iPad to research, document, and share their learning.	activities, especially when they were the special helper who led calendar activities on the SMART Board.	main reason for integrating technology. This was the most frequently selected response.
Literacy instruction	Used the SMART Board for shared writing activities. Stated that if students forgot spaces or reversed letters, they could easily be fixed without erasing or crossing out.	Heidi used Gmail and her projector to teach students how to write letters/compose emails to friends in their Global Read Aloud partner classroom.	Used the SMART Board to project students' storytelling workshop scripts and taught capitalization, punctuation, spacing, verbs, and nouns.	Geneviève used the SMART Board to access online books on the Epic website for whole-class reading and discussion about St. Patrick's Day.	39% of respondents integrated technology daily to develop literacy skills while 36% used it several times per week for this purpose.
Mathematics instruction	Danielle used SMART Notebook slides for Number of the Day activities, patterning, and problem solving. Danielle used manipulatives in SMART Notebook software.	Projected her teacher computer to display math manipulatives such as dice and base ten blocks when teaching and practicing math concepts.	When teaching students how to order numbers, used SMART Notebook's random number generator to produce numbers that students ordered in different ways.	Used the SMART Board to project PowerPoint slides with dot patterns to teach subitizing and part/whole thinking.	36% of respondents integrated technology daily to develop numeracy skills while 39% used it several times per week for this purpose.
Other content area instruction (Science, Social Studies)	When studying trees in Science, Danielle's students used the classroom	Heidi taught her students how to use Book Creator , and her students created	Integrated Social Studies and Science outcomes into inquiry-based	When teaching mapping from the Social Studies curriculum,	

Purpose	Danielle	Heidi	Arielle	Geneviève	Survey Results
	iPads for a scavenger hunt where they photographed different parts of trees.	a collaborative book about the ABCs of Canada to meet Social Studies outcomes. View PDF sample here .	learning. Used Microsoft Teams to video call an expert on the impact of plastics on oceans and marine animals.	Geneviève used Google Earth on the SMART Board for an aerial view of her students' neighbourhood and homes.	
Online access to resources for teachers and students	Danielle stated that she relied on the Internet for finding teaching resources such as Pinterest and Teachers Pay Teachers .	Heidi stated that she relies on the Internet for finding teaching resources such as Pinterest and Teachers Pay Teachers .	As a whole class, Arielle used SMART Board to watch YouTube videos (Octonauts , Wild Kratts) to research and fact check for inquiry projects.	Students used Chromebooks and the children's visual search engine Kiddle to conduct research for their inquiry projects.	11% of respondents reported that they used technology to support inquiry or project-based learning on a daily basis, 7% a few times per week, and 21% a few times per month.
Personalize learning, individualize instruction based on student needs, provide skill reinforcement, and additional practice	Used the apps Zorbit's Math Adventure and HearBuilder on individual iPads to personalize instruction and target specific skills.	Used the app Zorbit's Math Adventure on individual devices to personalize instruction and target specific skills for each student.	Arielle used Meerkat Math and Cookie Words apps on the classroom iPad for students to practice the skills that the class has learned as a whole group.	Geneviève used Epic on individual devices to personalize book selections for students based on their reading level and interests.	
Foster greater student independence	Danielle's students used iPads independently to capture photographs of work, caption it with audio or text,	Heidi's students became independent with logging in to Chromebooks and accessing online	During storytelling workshop, Arielle's students used the classroom iPad to independently film their play stories.	With video calls during remote teaching, her students learned how to deal with frozen video and	

Purpose	Danielle	Heidi	Arielle	Geneviève	Survey Results
	and upload it to Seesaw.	coding programs in Google Classroom.		being dropped from the call.	

Theme #2: Technology Integration to Build Community and Foster Connection

This theme highlights the transformative role of technology in fostering strong connections and community and emphasizes the importance of effective communication and collaboration among all stakeholders. At the heart of this theme is the use of the learning platform [Seesaw](#) as a powerful tool for family engagement, communication, and education. Integrated by all four teachers, Seesaw enabled seamless communication among teachers, students, and families, allowing for real-time updates, sharing of student work, and ongoing collaboration. This technology-based platform bridged the gap between the classroom and home, extending the learning community to include families as active participants in their children's education. Seesaw served an important function during the pandemic when face-to-face meetings and conversations were discouraged. During hybrid teaching in the spring of 2021, both Geneviève and Arielle used Seesaw to sustain the classroom community and stay connected with families.

Technology was a catalyst for building and strengthening the learning community within the classroom. In all four classrooms, the SMART Board or projector display functioned as a hub of collective learning and brought the teacher and the entire class together in community. One teacher noted that even though the children were spread around the room for social distancing requirements, the large display of the SMART Board made it possible for everyone to see and participate.

Table 5 provides specific examples of how all four teachers leveraged technology to communicate, build community, and foster family engagement during a global pandemic.

Table 5*Technology Integration to Build Community and Foster Connection*

Purpose	Danielle	Heidi	Arielle	Geneviève	Survey Results
To communicate with families	Used the Remind app to send text messages to families. However, she planned to switch to Seesaw for messaging the next school year.	Used Seesaw's messaging feature to send and receive messages from families. This has replaced email for this purpose.	Replaced weekly email newsletters with Seesaw's messaging feature to send and receive messages from families.	Used Seesaw's messaging feature to send and receive messages from families.	29% of respondents used technology on a daily basis to communicate or share what had been learned and 39% did so several times per week.
To share student learning, engage stakeholders, and encourage dialogue around children's learning	Families and school principal frequently left feedback on student learning posted in Seesaw. Noted that her principal asked questions about the learning and she could respond. Stated that children would ask parents to take pictures at home and post them in Seesaw to share with the school.	Students recorded their reading and posted writing samples to their Seesaw learning journals on a regular basis. Noted that families were more engaged and informed with Seesaw as compared to using a paper portfolio that they only saw at conferences.	Used Seesaw as a tool to teach families how to support early readers by posting games, ideas, and conversation prompts in students' learning journals. Highlighted the benefits of real-time sharing between school and home.	Posted photographs and videos of students to their Seesaw journals for parents to see (e.g, field trips, outdoor activities). Often children asked Geneviève to take videos and post them to Seesaw to share with their families.	Of the nine open-ended survey responses, two were coded <i>Seesaw for parent engagement and communication</i> . One teacher commented that they were impressed by the level of parent engagement with Seesaw.
To build community in the	Morning calendar and meeting time brought the entire class	Heidi's students worked in small groups to become	When students finished filming play stories, Arielle	When Geneviève moved to a hybrid teaching model	

Purpose	Danielle	Heidi	Arielle	Geneviève	Survey Results
classroom and school	together using the SMART Board. Students shared their likes/dislikes/interests through daily attendance slides and a special helper led the activities.	experts on coding apps. They led a code-a-thon in the school gym and gave the entire school an opportunity to learn how to code.	held movie screenings on the SMART Board with the whole class watching. The students were excited to share their work with peers.	during the pandemic, morning meeting on Microsoft Teams was the only time each day that all the students were able to connect with each other.	

Theme #3: Technology and Overcoming Barriers

This theme attempts to illuminate a paradox that I observed as I interviewed participants and analyzed the data: teachers leveraged technology for the purpose of overcoming barriers in education (accessibility, functionality, and remote and hybrid teaching models) but had to surmount technology-related barriers (device access, outdated software/hardware, time constraints) to do so. As this research focused on teachers with intermediate to strong technology skills, second-order barriers of teacher confidence and competence (Ertmer, 1999) were not observed. Instead, the resource barriers of technology access, outdated software/hardware, and time were greater factors. These barriers were not within teachers' control but sometimes hampered their efforts to integrate technology. The rural teachers in this study experienced greater access to technology and fewer resource barriers than their urban counterparts.

The pandemic was a large and unpredictable barrier throughout this research. One participant stated that "pandemic teaching is no joke" and teachers shared how they were challenged to use technology in new and different ways to cope with unprecedented situations. As teachers innovated and adapted using technology, they sometimes encountered barriers with technology that required another way to overcome the obstacle. For example, Geneviève used synchronous video calls to surmount the barrier of children learning at home. She frequently read picture books online during these video calls. While attempting to do so, the audio became delayed so that her voice did not match the pictures. To address this technology-related barrier, Geneviève started recording videos of herself reading the books and uploading them to her students' Seesaw learning journals. Table 6 provides examples of the how teachers integrated technology to overcome barriers as well as some of the barriers they experienced.

Table 6*Technology and Overcoming Barriers*

Purpose/Barrier	Danielle	Heidi	Arielle	Geneviève	Survey Results
To maintain educational continuity during COVID-19	Did not teach remotely during data collection, but supported students who were isolating at home. Work was assigned to Seesaw learning journals (activities from the Seesaw library and teacher-created activities). Students completed the work and Danielle provided feedback.	Did not teach remotely during the time of the study, but supported students who were isolating home. Work was assigned to Seesaw learning journals (activities from the Seesaw library and teacher-created activities). Students completed the work and Heidi provided feedback.	Winnipeg schools moved to hybrid learning in May and June 2020. Used Seesaw, Microsoft Teams, and other online resources to teach students remotely and delivered a different program to in-person learners.	Winnipeg schools moved to hybrid learning in May and June 2020. Used Seesaw, Microsoft Teams, Epic, Je Lis French literacy site, YouTube and other online resources. In-person learners followed the same program and accessed it from their Chromebooks.	18% of respondents used technology daily and 36% used it several times per week to teach remotely. 18% of respondents reported that their main purpose for using technology in the past year was to teach remotely.
To increase student accessibility	When posting work to Seesaw, students had the option of writing a caption or recording their voice explaining their learning. Danielle found audio recordings	To allow students to access online books easily, Heidi created and printed QR codes for students to scan with the iPad cameras.	Arielle enlarged text on the SMART Board for a student with visual impairments. When she used the SMART Board, he was able to track print and follow the	When teaching online, Geneviève recorded tutorial videos explaining new concepts and how to access websites/apps. She also recorded	29% of survey respondents reported that their main reason for integrating technology was to provide options for learning that would

Purpose/Barrier	Danielle	Heidi	Arielle	Geneviève	Survey Results
	helpful for emerging readers and writers and often recorded her voice to give instructions.		lesson. She also scanned picture books and projected them on the SMART Board for story time.	videos of reading books aloud.	not be possible otherwise.
Convenience and improvements in functionality, replacing traditional materials	Danielle discussed the convenience of creating, organizing, and saving materials in SMART Notebook, making it easy to extend learning from day to day.	Heidi relied on pre-made activities in the Seesaw library to save time. Heidi made her own activities if she could not find a pre-made one to use.	Arielle shared the advantages of documenting student ideas in SMART Notebook, then revisiting it the next day to review and add on to the learning.	Geneviève highlighted the convenience of being able to create learning materials (manipulatives for part/whole thinking) as they were required using SMART Notebook.	
Teacher adaptability and innovation	When children were unable to play in groups during the pandemic, Danielle created technology-supported play activities for individual children. Students used loose parts to create houses and other scenes, filmed	To share and collaborate with her partner classroom during the Global Read Aloud, Heidi added student work to a password-protected Seesaw blog. The website address and password were shared with the	When children could not work closely together during the pandemic, Arielle filmed conversations with individual students to showcase their thinking/inquiry projects, added them to Seesaw,	During remote teaching, Geneviève realized that some of her students could not read the daily schedule posted to Seesaw. She started adding a voice recording of the schedule so that students could	

Purpose/Barrier	Danielle	Heidi	Arielle	Geneviève	Survey Results
	them, and uploaded them to their Seesaw learning journals. View sample here .	partner classroom in Alberta, and the students were able to view their work and comment on it.	then played them for the whole class on the SMART Board.	follow along as they listened to the recording.	
Time constraints	Danielle shared that students could be off task and waste time with technology. Examples included taking silly pictures with the iPad camera or changing their emoji in Epic instead of reading books.	Heidi discussed the time wasted when waiting for her projector display to turn on or for the iPad to connect to it. Commented on the amount of time it takes to teach children how to use technology and long it takes for students to become independent.	Arielle shared that when technology did not work, an entire block of learning was disrupted and time was wasted as she pivoted to find another way to teach the lesson.	Geneviève discussed how getting students set up with new websites, apps, or tools could be frustrating and time consuming, especially when technology did not work properly.	One open-ended survey response was coded <i>limited time to learn to use new technology</i> and another was coded <i>limited time for technology in Kindergarten</i> . Both responses demonstrated the time constraints teachers experienced.
Access to devices, infrastructure	Five classroom iPads but had access to a class set. Supplemented classroom technology with her personal iPhone. School Internet was fast and reliable but	Access to a shared set of Chromebooks but would have preferred one-to-one iPads. Had six iPads for student use. Supplemented classroom technology with her	Had one classroom iPad that supported movie creation, documentation of learning, research, and practice/skill reinforcement with apps. Supplemented with her personal	Had no iPads but accessed a shared class set of Chromebooks as often as possible. Supplemented classroom technology with her personal iPhone.	50% of survey respondents indicated that access to devices was their most significant barrier to integrating technology.

Purpose/Barrier	Danielle	Heidi	Arielle	Geneviève	Survey Results
	some families experienced connectivity issues.	personal iPhone. Fast and reliable Internet.	iPhone. Internet was generally fast and reliable.	Internet was generally fast and reliable.	

Theme #4: Technology to Enact Pedagogical Beliefs and Align with Personal Passions

The research provided evidence that teachers' technology integration practices are shaped by their pedagogical beliefs through complex and synergistic interactions (e.g., Cheng et al., 2020; Hsu, 2016; Kim et al., 2013; Tondeur et al., 2017). This theme explores the alignment between participants' technology-supported teaching activities and their pedagogical beliefs. It provides insight into how teachers integrated technology to enact their pedagogical beliefs and preferred approaches, how teachers' own interests and priorities shaped their practice, and the degree to which they used technology to honour student choice and voice.

At the beginning of the study, all participants were asked to place themselves on a continuum spanning teacher to student-centred practice. They described their beliefs about how children learned best, how they planned and implemented learning activities, and what they prioritized most in teaching and learning. For the most part, I observed a strong correspondence between participants' beliefs and how they described their technology integration practices.

However, variation in beliefs and pedagogical approaches between rural and urban teachers were evident within this theme. Both rural and urban teachers integrated technology to enact their pedagogical beliefs, but their beliefs and practices differed. Urban teachers appeared to place a higher value on student interests and used technology to explore the complex topics that arose from their students' play, experiences, and questions. In keeping with their self-expressed beliefs, rural teachers described integrating technology to meet curricular outcomes, develop skills, and maintain an organized and structured classroom. More information and specific examples are available in Table 7.

Table 7*Technology to Enact Pedagogical Beliefs and Align with Personal Passions*

Purpose	Danielle	Heidi	Arielle	Geneviève	Survey Results
Personal description of practice	Described her practice as midway between teacher and student centred with students achieving more independence throughout the school year. Confident technology user who highly valued technology.	Described her practices as highly structured and teacher led, stating that she needed structure and that students functioned better with structure. Engaged, fairly confident technology user who highly valued it.	Described her practice as student centred. As a teacher, she strived to meet the needs and explore the interests of children. Confident technology user who highly valued technology.	Described her practice as more student centred than teacher led. Used student interests as the focus of her teaching and as a vehicle for teaching the curriculum. Confident technology user who highly valued technology.	When rating their confidence levels when integrating technology using a scale of 1-5 (1=not at all confident, 5=extremely confident), the mean score was 3.54 with 54% of teachers selecting 4 or higher.
To enact pedagogical beliefs	Intentional user of technology who valued structure and routine. Integrated technology to teach the curriculum, communicate with families, and develop and maintain routine.	Economy-driven perspective on technology integration. Integrated technology to develop important skills for academic success and potential career options.	Saw herself as a co-learner and facilitator of inquiry-based, interdisciplinary learning. Integrated technology to support children's needs, honour their interests, and build community.	Saw herself as a guide who integrated technology to explore student interests and important world issues such as diversity and racism.	
To enact personal preferences, interests, or priorities	Prioritized connection as the foundation of successful teaching.	Expressed a strong preference for coding and collaborative	Prioritized cultivating a strong sense of belonging for children and	Passionate about anti-racism education. Used social media to	

Purpose	Danielle	Heidi	Arielle	Geneviève	Survey Results
To honour children's interests	<p>Used Seesaw to build and sustain connection with families and children.</p> <p>Danielle enjoyed a structured classroom but provided choice. Allowed students to select books on the Epic app that interested them during ELA. Provided students with the skills and iPad access to post to their Seesaw learning journals when they wished.</p>	<p>activities. Used coding apps and sites on iPads and Chromebooks and participated in The Global Read Aloud using technology tools.</p> <p>Heidi enjoyed a structured classroom but provided choice within this structure. Gave choice to students within Daily 5 ELA and math activities by allowing them to select a variety of apps and websites.</p>	<p>their families. Used Seesaw to document, share learning, communicate with families, and build community in the classroom.</p> <p>Arielle encouraged students to choose their own topics for inquiry-based projects and develop their own stories during storytelling workshop. Supported students with using the classroom iPad to research, record soundtracks, and create movies.</p>	<p>build her own understandings about topics to guide her students. Shared learning and built community through Seesaw and social media.</p> <p>Geneviève used tools such as Kiddle and Chromebooks to allow students to research their self-selected inquiry topics. Inquiry-based projects were documented and shared with families in Seesaw.</p>	<p>21% of respondents used technology daily and 32% used it several times per week to research a new idea, topic, or project. 11% of respondents used technology on a daily basis and 7% used it several times per week to support inquiry/project-based learning.</p>

Summary

In this chapter, I integrated the quantitative results and qualitative findings in a cross-case analysis. Using framework matrices, specific examples of teacher practice from the multiple-case study were displayed alongside the relevant quantitative results to enhance understanding and provide additional context for both kinds of data. Two overarching themes and four themes were developed with evidence from each case. Unique features of teachers' practices, shifts in technology integration due to COVID-19, and similarities and differences between rural and urban teachers were also discussed.

After analyzing the data in its entirety, it is possible to return to the original research questions with greater clarity. Although there was variation in teachers' pedagogical beliefs and device access, there was significant similarity in their purposes for using technology. Teachers integrated technology in their Kindergarten-Grade 2 classrooms for the common purposes of enhancing teaching and learning, building community and fostering connection, overcoming barriers and maintaining educational continuity during COVID-19, and enacting their pedagogical beliefs and personal preferences. They accomplished this technology integration by leveraging powerful and versatile platforms and tools such as Seesaw, iPads, Chromebooks, SMART Boards or a similar projector display, and a variety of online resources and apps. Amid all these teaching and learning activities, teachers endeavoured to balance screentime, creation, and consumption, while imparting essential digital competencies.

In the next chapter, I provide a review of the previous six chapters and discuss the potential contributions of this research, the limitations of this study, theoretical and pedagogical implications and considerations, suggestions for policy, implications related to COVID-19, and future directions.

Chapter 7: Conclusions, Implications, and Further Thoughts

In this study, my aim was to provide a rich description of primary teachers' technology-supported practices in rural and urban Manitoba during a global pandemic. The goal of examining this topic was to gain insight into how and why teachers used technology, describe promising practices, and reveal unique approaches to technology integration that arose as a response to contexts created by the pandemic. As I was unable to visit schools in person due to the pandemic, my research focused on engaging online with primary teachers from one rural and one urban Manitoba school division. I investigated teachers' technology-integrated practices during the 2020-21 school year with an awareness of the great demands placed on teachers' resilience and mental health.

As I explored Kindergarten-Grade 2 teachers' classroom technology integration, I learned more about their pedagogical influences and beliefs, their attitudes and values in relation to technology, and their technology-supported teaching and learning activities. The next section provides a brief summary of each chapter of my dissertation.

Synopses of Chapters

My research process and findings were documented in a seven-chapter dissertation. The first chapter introduced the topic under study and the theoretical framework and provided a current snapshot of conditions in education and the broader world at the time of writing. In Chapter 2, I presented a timeline of important events in the development and implementation of educational technology, followed by a review of the literature on primary teachers' technology integration. The chapter concluded with an examination of pandemic pedagogy and the repercussions for teacher mental health. In Chapter 3, I discussed the research design and outlined the specific methods selected to investigate teachers' technology-supported classroom

practices. In the beginning section, I provided an overview of mixed-methods approaches, including the blend of qualitative multiple-case study and quantitative survey, and shared my rationale for the use of these methods. In the second section, I discussed how research sites and participants were chosen and offered a description of the participants and their school and classroom contexts. I also provided a timeline of pandemic events in Manitoba and detailed the pandemic teaching context. Next, I explained the quantitative and qualitative data collection procedures used. This was followed by an account of data analysis procedures and a discussion of my positionality as a researcher. Lastly, I examined the four components of trustworthiness and how I addressed them in my research.

In Chapters 4 and 5, I presented the data generated by the quantitative survey followed by vignettes of each teacher drawn from the qualitative multiple-case study. In each vignette, I outlined teachers' technology use through the lens of my research questions. Vignettes included examples of technology integration to deliver the curriculum, enhance communication and connection, implement inquiry-based and play-based learning, explore issues of diversity and identity, sustain education during COVID-19, participate in a global collaborative project, and develop coding and computational thinking skills. In Chapter 6, I integrated the quantitative survey results with the qualitative findings to provide further insight into how and why teachers integrated technology. This was accomplished by including relevant quantitative information within the visual display of the cross-case analysis. In the cross-case analysis, I compared the four teachers' cases using framework matrices for ease of interpretation. Important similarities and unique differences among the teachers' technology-supported practices were highlighted to further address the research questions. Two overarching themes and four themes were developed: i) versatile and powerful tools and platforms; ii) striking a balance and developing

digital competencies; iii) technology to enhance the learning and teaching process; iv) technology integration to build community and foster connection; v) technology and overcoming barriers; and vi) technology to enact pedagogical beliefs and align with personal passions. In the next section, I review this research's potential contributions to the field of educational technology integration.

Contributions of the Study to the Field of Educational Technology Integration

This study has contributed to the body of knowledge of primary teachers' technology integration practices in several ways. First, this study provides strong evidence that primary teachers in rural and urban Manitoba classrooms are indeed integrating technology in many ways to accomplish a plethora of purposes. Although practices are varied, the findings confirmed that teachers rely on technology to communicate and build community, to make learning more accessible and convenient, to teach the curriculum and build skills, to access resources, and to improve the teaching and learning process. Teachers make use of versatile and powerful platforms (e.g., Seesaw, Microsoft Teams, and Google for Education) and tools (such as iPads and interactive whiteboards) that help them accomplish these goals.

Secondly, the study's findings have provided documentation of the devices and infrastructure that may support or challenge teachers' efforts to integrate technology in Manitoba schools. As noted by Ivus et al. (2020) and Nantais et al. (2021), technology is present in schools and its use is evident with all ages of children. However, there is significant variability among classrooms and school divisions (and classrooms within the same division) as to what technology devices and support is available to teachers and learners. Naturally, teachers' efforts to integrate technology proceed more smoothly with an abundance of devices and support. As this is not the

case for every educator, this study sheds light on the teacher's own agency in integrating technology, regardless of numbers of classroom devices or availability of support.

Thirdly, this study emphasized that teachers themselves are a vitally important factor in classroom technology use. This was clearly illustrated by the two urban teachers, Arielle and Geneviève. Despite the barrier of minimal classroom devices, they integrated technology in innovative ways to enact their pedagogical beliefs about teaching and learning. Although many studies have discussed the connection between pedagogical beliefs and teacher technology integration (e.g., Burke et al., 2018; Hermans et al., 2008; Tondeur, 2020; Tondeur et al., 2017), this study provided detailed examples of how teachers overcame barriers of device access and pandemic teaching conditions to integrate technology successfully.

Moreover, this research made it clear that differences exist between rural and urban teachers' pedagogical beliefs and access to technology. The two urban teachers, Arielle and Geneviève, described their practices as student centered and were passionate about inquiry-based learning as a vehicle for honouring children's interests. This pedagogical approach was not evidenced in the classroom practices of the rural teachers, Danielle and Heidi. Both rural teachers detailed practices that were more teacher led and expressed strong preferences for structure and routine. A second variation between rural and urban teachers was availability of technology devices and support. The two rural teachers enjoyed strong access to devices and the support of a technology coach while the two urban teachers struggled to access iPads or technology support. Despite these differences, all four teachers integrated technology to enact their pedagogical beliefs, interests, and priorities. These differences in the practices of the rural and urban teachers suggest that more research is required to better understand whether these variations carry across a larger sample of urban and rural teachers.

Perhaps one of the most important contributions of this study is the rich descriptions of teacher practice. Nearly twenty-five years ago, Ertmer (1999) argued that technology integration could not be measured by counting classroom devices or tracking how many hours they were used. They believed that observing how teachers used technology to improve teaching and learning was the true measure of technology integration. Since then, other researchers have recommended that more information was needed to explain how and why teachers use technology with students (e.g. Kerckaert et al., 2015; Nikolopoulou & Gialamas, 2015; Tondeur et al., 2013; Vidal-Hall et al., 2020). Although the pandemic curtailed my efforts to observe within classrooms, I believe that extensive interviews with teachers and examination of student work samples have allowed me to create the detailed examples of teacher technology integration that may have been lacking in the literature.

Finally, this study has documented the range of possibilities that exist when teachers integrate technology. Although it feels clichéd to say so, technology in the hands of teachers and students can be truly transformative. Conversely, technology may also act as a substitution for pencil and paper, offering only functional improvement to the learning task (Puentedura, 2014). Evidence of both ends of this spectrum and the various places between are described in this study, from practicing math facts on an iPad app to collaborating with another classroom across the continent to discuss literature and learn about another location. Coupled with the student and teacher engagement consistently described by the four participants, both simple and rich technology-supported activities have the potential to enhance teaching and learning.

Theoretical Implications

In this section, I revisit the theories that framed this study to discuss how my research aligns as well as contributes to both sociocultural theory and multiliteracies. From the beginning,

sociocultural theory was an excellent fit for examining teacher practice and cultural tools.

Unexpectedly, it gained new significance when teaching and learning in traditional ways shifted due to a global pandemic.

Throughout my data collection and analysis, the role of the teacher (and sometimes peers) as the more knowledgeable other was clearly represented. Sometimes, this looked like the teacher guiding the student, step by step, to learn how to use an app, program a code, or create a multimedia project. Other times, this was represented in teachers' integration of technology to personalize learning. For example, all teacher participants made use of apps that levelled instruction or activities to each student's ability level. Both activities allowed students to function in their zones of proximal development and experience success. Additionally, teachers themselves received support from other teachers in their efforts to integrate technology. In the rural school division, both Danielle and Heidi had access to a technology coach who provided suggestions as well as modelling to strengthen their own abilities to teach with technology. This technology coach served as a more knowledgeable other and placed teachers within their own zones of proximal development. For both teachers and students, sociocultural theory revealed how knowledge was constructed socially and mediated individually through descriptions of teacher practice and the examination of student work samples.

Multiliteracies theory and its multiple modes of representation increased understanding of teachers' use of multimodal platforms and apps such as iMovie, Seesaw, Epic, and Chatterpix Kids. Students were able to document their learning through images, audio, and video. Arielle's students created rich multimedia productions that shared their learning with the classroom community as well as their families. During the pandemic, teachers used the multimodal affordances of Seesaw and Microsoft Teams to demonstrate, share videos and video tutorials,

and provide audio instructions and feedback. Students were able to respond with their own audio, video, and images. Through their integration of technology, teachers emerged as intentional designers of the learning environment. The affordances of technology supported teachers' and students' multiple modes of expression in regular classroom activities as well as in remote and hybrid teaching situations.

Implications for Teachers and Teacher Education Programs

According to Labaree (2003), teachers firmly believe that only fellow teachers have the authority to speak about teaching and the educational process. As a teacher-researcher whose work has amplified the voices and practices of Manitoba teachers, I believe that these detailed accounts of teachers' technology integration will resonate with practicing and pre-service teachers. This dissertation shares rich descriptions and in-depth examples of proven and promising technology-supported teacher practices such as coding and computational thinking, digital storytelling, moviemaking, and use of digital platforms such as Seesaw and Microsoft Teams. Pedagogical approaches that include project-based learning, inquiry-based learning, classroom collaboration, and anti-racism/diversity education, supported by technology, are also described in my research.

The previous chapters not only documented why primary teachers integrated technology but exactly how they did so. When transformed into a more user-friendly format, this dissertation may function as a guidebook for teacher candidates and practicing teachers to strengthen their knowledge of effective technology-supported pedagogical practices. Perhaps the vignettes included in this dissertation may be used to spark discussion and provide authentic examples of technology integration for teacher education programs. The voices of educators from the field

may resound more intensely for teachers than an unknown researcher, resulting in greater transmission and implementation of strong technology integration practices.

This study may also inform course content and objectives in teacher education programs, such as: i) the role of technology in student-centred pedagogical approaches such as inquiry-based learning and play; ii) key tools and platforms such as Microsoft 365, Google for Education, Seesaw, interactive displays, and quality educational apps; iii) teaching coding and computational thinking; iv) the role of technology in collaborative projects with other classrooms and organizations; v) using technology safely and appropriately to develop digital skills; and vi) in the event of another pandemic, successful remote and hybrid teaching practices and tools.

Implications for School Leaders, School Divisions, and Policy Makers

This study has provided evidence that teachers continue to encounter obstacles in their efforts to integrate technology effectively. Findings from this study may contribute to the discourse on the digital divide in rural and urban areas and how school leaders may seek to mitigate these disparities. Specific examples and teacher anecdotes from my research illustrated how technology has helped educators surmount barriers and how device access and connectivity have posed significant barriers to effective technology integration. Drawing from the voices of multiple stakeholders, this information may assist educational leaders in developing a more equitable vision for technology-supported teaching and learning. To make this vision a reality, educational leaders must consider who requires access to technology, develop a process for equitable allocation of technology resources, and examine how bias may be informing current decisions. With the evidence provided by this study, administrators and school board members may be motivated to advocate for improved access to funding for devices, high-quality content

and resources, and professional learning opportunities (including ongoing mentorship as well as professional learning sessions) for the educators and students they lead.

Although this study has documented how motivated teachers may compensate for a lack of devices, it is unfair for Manitoba Education (Manitoba Education and Training, 2016) to mandate technology integration without making adequate provision for it. As described in Danielle's profile, her school secured interactive whiteboards, iPads, and Chromebooks through the support of a community organization. Usually, these external funding opportunities are obtained through presentations or lengthy grant applications that busy teachers and school leaders may not be aware of or have time to complete. Provincial school division funding and school board budget decisions are complex and multifaceted issues that are not within the scope of this dissertation to explore in detail. However, it is a realistic expectation that if teachers are required to integrate technology, all classrooms and schools should have reasonable access to it that do not require their own efforts to secure. The findings of this study are a rich source of information for decision-makers to support their understanding of this issue and inform upcoming funding decisions (Hollands & Escueta, 2019) for technology budgets in schools.

Implications Related to COVID-19 and Global Pandemics

As described in Chapter 1, when this study was undertaken, strict pandemic restrictions were in place that impacted nearly every aspect of teaching and living. As I conclude this final chapter, schools have returned to pre-pandemic conditions with COVID-19 school guidance still in place (Government of Manitoba, 2023). As detailed throughout this study, teachers experienced disparity in their access to technology. The pandemic exacerbated these issues while forcing teachers and students to use technology in new and different ways. This research has revealed unique approaches to technology integration that arose during COVID-19 and

underscored the need to prepare teachers in advance to teach in remote and hybrid situations. First, planning for and implementing remote and hybrid teaching models must be included in teacher education programs. This could be accomplished by familiarizing teacher candidates with key platforms and tools, exploring effective online pedagogical approaches, and studying examples such as the ones provided by this study.

Second, this study has emphasized the role of technology in maintaining classroom community and the social construction of knowledge during pandemic teaching conditions. Geneviève's daily Microsoft Teams video calls with children joining from the school as well as their homes demonstrated the affordances of technology to maintain peer relationships online during a hybrid teaching situation. Arielle used the power of Seesaw and her interactive whiteboard to include all learners in the inquiry process by filming and projecting important moments in individual children's inquiry projects. All children were able to benefit and learn from the achievements of their peers because of their teacher's intentional use of technology. Including hybrid and remote teaching practices in provincial curricular documents and teacher education programs may simplify the planning and implementation process in the event of another global pandemic.

Limitations

It is important to consider that the findings gleaned from a small quantitative online survey and a multiple-case study of four teachers may have limited generalizability. I acknowledge that these findings are not representative of all Kindergarten-Grade 2 teachers in the participating school divisions, let alone the province or country. However, I maintain that the technology integration practices described in this study facilitate comparison to other cases in Manitoba, as well as Canada and the United States.

It is obvious that the greatest limitation to this study was my inability to observe actual classroom practice and instead rely on teacher self-report. Unfortunately, this was beyond my control as COVID-19 regulations prevented outside visitors (including families) from accessing schools. It is serendipitous that the very thing I was studying facilitated my ability to engage deeply with research participants. The affordances of technology made it possible for me to “see” my participants during our interviews and easily view the work samples that were shared with me. Examining student work samples provided a way for me to confirm what participants had shared with me. Using shared files in Microsoft OneDrive, my research participants reviewed their interview transcripts and the vignettes I developed to make necessary changes or to confirm that they were accurate. Perhaps the compensation for not being able to access schools was the gift of collecting data in such an unprecedented time in educational history. I am honoured to share the experiences of my research participants who so willingly gave me their time when our world was turned upside down.

Further Research

As mentioned throughout this dissertation, there is a need for more research that provides actual descriptions of how teachers integrate technology in their classrooms. Considering the previously stated limitations, I see a need for in-person observations of classroom practice over an extended period. In this study, I offered insight into the technology-supported teaching practices of four Manitoba Kindergarten-Grade 2 teachers. Further research into how and why teachers integrate technology as well as the barriers they experience is required in Northern Manitoba as well as Indigenous communities. Additionally, a broader picture of Kindergarten-Grade 2 teachers’ technology use, perhaps obtained via online survey or focus groups by Manitoba Teachers’ Society or Manitoba Education and Early Learning, would be both

enlightening and useful. Teachers continue to juggle access to technology, the demands of the curriculum, time constraints, screen time, pedagogical beliefs, and the ever-present possibility of another global pandemic. Through further research, the opportunity to share their stories will provide guideposts for other educators as well as direction for educational leaders and policymakers.

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Appendix A Survey Questions

Early Years Teachers' Purpose and Practice with Technology

Please complete this brief survey to provide insight into how and why you integrate technology in your teaching practice. Technology integration is defined as the use of hardware such as laptops, interactive whiteboards, digital cameras, robotics, and handheld devices, as well as software programs, applications, and the Internet, in classrooms for supporting and enhancing learning (Hsu, 2016).

All responses will be kept anonymous and used to support my doctoral research. Thank you so much for your time.

Approximate time to complete: 10 minutes

* Required

1. Where is your school located? *

- rural school division
- urban school division

2. What grade(s) do you teach? Check all that apply. *

- Kindergarten
- Grade 1
- Grade 2
- Other

3. How many years of teaching experience do you have in an early years setting? *

- 0-5 years
- 6-10 years
- 11-15 years
- more than 16 years

4. On a scale of 1-5 where 1 means not at all confident and 5 means extremely confident, how confident do you feel when you integrate technology in your classroom? *

- 1 2 3 4 5
-

5. On a scale of 1-5 where 1 means beginner and 5 means expert, how would you rate your ability to successfully integrate technology in your teaching? *

- 1 2 3 4 5
-

6. In the past school year, how often did you use the following technology tools/devices in your classroom? *

	Every day	A few times per week	A few times per month	A few times per year	Never
Interactive whiteboard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
iPad or other tablet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chromebook	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Every day	A few times per week	A few times per month	A few times per year	Never
Laptop or computer workstation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Document camera	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Projector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Robotics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Applications (apps)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Microsoft Office 365 tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Google for Education tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. In the past school year, how often did you integrate devices/technology for the following purposes in your classroom? *

	Every day	A few times per week	A few times per month	A few times per year	Never
To develop numeracy skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To develop literacy skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To collaborate with another classroom or organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To communicate or share what has been learned	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To research a new idea, topic, or project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Every day	A few times per week	A few times per month	A few times per year	Never
To create a product , image, or book	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To support interdisciplinary learning (multiple subjects) such as inquiry or project-based	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To learn to code	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To develop computational thinking skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To assess student learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. Some teachers love integrating technology (a score of 5) while others feel that it does not belong in an early years classroom (a score of 1). Where do you fit on this spectrum? *

1 2 3 4 5

9. What is your main reason for integrating technology in your classroom? *

- saves time
- provides options for learning that wouldn't be possible otherwise
- increases student engagement
- increases my engagement as a teacher
- I only integrate technology because I am required to

I don't integrate technology in my classroom

10. Do you experience any barriers to integrating technology in your classroom? *

Access to devices

Lack of reliable internet

Lack of tech support

Lack of support from administration

Lack of support from students' families

things do not work reliably

Classroom management/behavior issues when using technology

I don't experience any barriers to integrating technology in my classroom practice.

11. Please tell me anything else I should know about how and why you use technology in your classroom.

12. I am recruiting teachers who regularly integrate technology to participate in a case study. This case study would involve me spending time in your classroom and interviewing you. Would you be interested in participating? Please comment below with your full name and an email address which may be used to contact you.

Appendix B Ethics Certificate



**University
of Victoria**

Office of Research Services | Human Research Ethics Board
Michael Williams Building Rm B202 PO Box 1700 STN CSC Victoria BC V8W 2Y2 Canada
T 250-472-4545 | F 250-721-8960 | uvic.ca/research | ethics@uvic.ca

Certificate of Approval - Annual Renewal

<p>PRINCIPAL INVESTIGATOR: Jodi Streeleasky (Supervisor)</p> <p>PRINCIPAL APPLICANT: Devon Caldwell PhD student</p> <p>UVIC DEPARTMENT: Curriculum and Instruction EDCI</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: #e1eef6;">ETHICS PROTOCOL NUMBER</td> <td style="background-color: #e1eef6;">20-0298</td> </tr> <tr> <td colspan="2" style="background-color: #e1eef6;">Expedited review - delegated</td> </tr> <tr> <td>ORIGINAL APPROVAL DATE:</td> <td>21-Aug-2020</td> </tr> <tr> <td>APPROVED ON:</td> <td>02-Aug-2023</td> </tr> <tr> <td>APPROVAL EXPIRY DATE:</td> <td>20-Aug-2024</td> </tr> </table>	ETHICS PROTOCOL NUMBER	20-0298	Expedited review - delegated		ORIGINAL APPROVAL DATE:	21-Aug-2020	APPROVED ON:	02-Aug-2023	APPROVAL EXPIRY DATE:	20-Aug-2024
ETHICS PROTOCOL NUMBER	20-0298										
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ORIGINAL APPROVAL DATE:	21-Aug-2020										
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APPROVAL EXPIRY DATE:	20-Aug-2024										
<p>PROJECT TITLE: Purpose and pedagogy: Teachers' use of technology in primary classrooms</p> <p>RESEARCH TEAM MEMBERS: None</p> <p>DECLARED PROJECT FUNDING: Social Sciences and Humanities Research Council (SSHRC), University of Victoria</p> <p>DOCUMENTS INCLUDED IN THIS APPROVAL: tcps2_core_certificate.pdf - 19-Jun-2020 web-based survey link.pdf - 24-Jun-2020 introductory letter to survey respondents.pdf - 24-Jun-2020 research request and consent_PWSD.pdf - 06-Jul-2020 research request and consent_Seven Oaks SD.pdf - 06-Jul-2020 interview questions for teachers.pdf - 06-Jul-2020 Online survey.pdf - 10-Aug-2020 information letter for families.pdf - 20-Aug-2020 implied consent_survey participants.pdf - 20-Aug-2020 teacher participant form.pdf - 20-Aug-2020</p>											
Conditions of approval											
<p>This Certificate of Approval is valid for the above term provided there is no change in the protocol.</p> <p>Amendments To make changes to the approved research procedure in your study, please submit "Amendments" or "Annual renewal with amendments" form. You must receive research ethics approval before proceeding with your amended protocol.</p> <p>Renewals Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.</p> <p>Project Closures When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.</p>											
Certification											
<p>This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria's policies for research involving human participants.</p>											

Appendix C

Letter of Information for Consent: Superintendent



**University
of Victoria**

***Letter of Information for
Consent: Superintendent***

Purpose and pedagogy:

Teachers' use of technology in primary classrooms

Dear Superintendent:

My name is Devon Caldwell, and I am a doctoral candidate in the Department of Curriculum & Instruction at the University of Victoria. I am also a practicing Kindergarten teacher in Fort La Bosse School Division in Oak Lake, Manitoba. I am writing to ask your permission to invite Kindergarten-Grade 2 teachers within your school division to participate in a dissertation research study.

My research focuses on primary teachers' technology use, which may include their technology-supported remote teaching activities during the pandemic. With your permission, I would like to survey all Kindergarten-Grade 2 teachers in your division. Following the administration of this brief online survey, I intend to approach two Kindergarten-Grade 2 teachers from your division as potential case study participants. Finally, I would like to review division policy documents related to technology integration and education during the pandemic. Information about the research follows.

I fully understand that the current situation is uncertain and it is difficult to predict what will happen by next fall; as a result I plan to collect all data virtually without any in-person contact.

Research Project Title: Purpose and pedagogy: Teachers' use of technology in primary classrooms

Researcher: Devon Caldwell

Human Research Ethics Board Protocol Number: 20-0298-02

As a doctoral candidate, I am required to conduct research as part of the requirements for a Doctor of Philosophy in Curriculum & Instruction. It is being conducted under the supervision of Dr. Jodi Streelasky.

Purpose and Objectives: This study explores two questions through a mixed-methods case study design of four Kindergarten-Grade 2 classrooms in rural and urban Manitoba: (i) In what

ways is technology being used in primary classrooms?; and, (ii) What are teachers' purposes for integrating technology? My research seeks to provide in-depth examinations of teachers' perspectives and rationales as to why they have included specific technologies and digital experiences in their pedagogical practices.

Importance of this Research

There is a need for research in Manitoba that provides insight into primary teachers' technology-integrated practices. This research has the potential to inform professional learning opportunities, division policy development, and planning for emergency remote learning. Rich descriptions of teacher practice can create models of innovation that other teachers can draw from to strengthen practice. The ongoing, reflexive nature of the interviews may be a benefit to participants. In addition to guiding individual teachers, my upcoming research may also play a role in strengthening the development of pre-service and practicing teachers.

Participants' Involvement: Participating in this study would not require any interruption of regular duties of the teachers.

The two case study participants (teachers) from your school division will be expected to:

1. Complete the online survey administered to all K-2 teachers in the division.
2. Participate in a series of short virtual interviews approximately every four weeks throughout the study (October-May), at a time convenient to the participant.
3. Spend approximately 20 minutes after each interview reviewing the interview transcripts.
4. Provide copies of relevant teaching materials, such as lesson plans, recorded lessons, and anonymized student work samples.
5. If they are willing, allow the use of their professional social media interactions as data (e.g. Twitter or a blog).

Risks and Benefits: The risks in this study are minimal, if any. There may be a chance that reflecting on practice could be uncomfortable for participants; however, usually such critical reflection is considered a benefit. A benefit, in addition to the altruistic one of participating in the advancement of knowledge, is the opportunity to discuss and reflect critically on practice in a non-threatening situation.

Anonymity and Confidentiality: Participating teachers will have the option to request anonymity through the use of pseudonyms. Participants will be asked to sign a consent form that will indicate the interviews will be recorded. Participating teachers may answer only those questions with which they feel comfortable. Participants may withdraw from the study at any time by contacting me; at this time, they will be given the option of allowing their data to be used or destroyed.

Participants will also have the opportunity to review the transcripts from the semi-structured interviews in order to add, delete, or change responses. During the research, access to the materials will be limited to me, potentially my advisor, and possibly, a transcriber for recorded interviews. The transcriber, if one is used, will be required to sign a confidentiality agreement

and participants will also be informed on the consent form that a transcription service may be used.

No personal information about students will be used in the data. Participants will be asked to not mention specific students in interviews. Any inadvertent disclosures will be deleted from transcripts and not used. Additionally such disclosures will remain confidential.

All research data will be stored securely using Microsoft 365 OneDrive. The data will be stored for five years beyond the successful defense of my dissertation, then destroyed.

Dissemination of Results: Following the conclusion of data collection, findings will be disseminated through a dissertation as well as scholarly publications and conference presentations. I am eager to share my research findings through the development of an executive summary and accompanying presentation designed for practicing and pre-service teachers, administrators, and school board members in your division and others. All workshops and presentations would be made available to stakeholders in your division through in-person or virtual means. Research findings may also be shared through podcasts and social media to make information more accessible and relevant.

Should you provide me with permission to proceed with this research, please sign the consent form that is attached to this letter and return it to me. If you have any questions about this request, please contact me. If you do not wish teachers within your school division to participate, please let me know by contacting me by email.

Sincerely,

Devon Caldwell
PhD Candidate, University of Victoria

Superintendent's Consent

I, _____, hereby give permission for Devon Caldwell to survey all Kindergarten-Grade 2 teachers in Seven Oaks School Division. I also give Devon Caldwell permission to contact potential case study participants and their principals to participate in the research study entitled, **Purpose and pedagogy: Teachers' use of technology in primary classrooms**, to be conducted during the 2020-2021 school year.

By signing this permission form, I consent that I understand the following:

- the researcher will provide an online survey to be distributed to all Kindergarten-Grade 2 teachers
- the researcher will individually interview and digitally record selected teachers at a time and place convenient to the participants as a means of data collection
- the researcher will collect relevant documents and artifacts, such as divisional technology use guidelines, recorded lessons/lesson plans, and anonymized student work samples as a means of data collection
- participation in this study will not interfere with the regular duties of the participants
- no identifying information about students will be used in the data
- teachers have the option of remaining anonymous through the use of a pseudonym
- this research will be shared and published for the benefit of knowledge development

Signature of Superintendent

Date

Appendix D

Letter of Information for Consent: Teacher



Letter of Information for Consent: Teacher

Purpose and pedagogy:

Teachers' use of technology in primary classrooms

Dear _____:

My name is Devon Caldwell, and I am a doctoral candidate in the Department of Curriculum & Instruction at the University of Victoria. I am also a practicing early years/resource teacher in Fort La Bosse School Division in Oak Lake, Manitoba. I am writing to invite you to participate in a dissertation research study.

My research focuses on primary teachers' technology use, which may include technology-supported remote teaching activities during the pandemic. I am interested in including two Kindergarten-Grade 2 teachers from your division as case study participants. I would also like to review division policy documents related to technology integration and education during the pandemic.

I fully understand that the current situation is uncertain and it is difficult to predict what will happen; as a result I plan to collect all data virtually without any in-person contact.

Research Project Title: Purpose and pedagogy: Teachers' use of technology in primary classrooms

Researcher: Devon Caldwell

Human Research Ethics Board Protocol Number: 20-0298-02

Purpose and Objectives: This study explores two questions through a mixed-methods case study design of four Kindergarten-Grade 2 classrooms in rural and urban Manitoba: (i) In what ways is technology being used in primary classrooms?; and, (ii) What are teachers' purposes for integrating technology? My research seeks to provide in-depth examinations of teachers' perspectives and rationales for integrating technology in their teaching practices.

Importance of this Research

There is a need for research in Manitoba that provides insight into how and why teachers of young children integrate technology. This research has the potential to inform professional learning opportunities, teacher education, division policy development, and planning for

emergency remote learning. Rich descriptions of teacher practice can create models of innovation that other teachers can draw from to strengthen practice.

Participant Selection: You are being asked to participate in this study because you are a practicing Kindergarten-Grade 2 teacher who has been identified as having intermediate to advanced technology skills and regularly integrates technology.

Participants' Involvement: Your regular classroom duties will not be interrupted by this study.

As a teacher participating in this study, you will be requested to:

1. Participate in a series of short virtual interviews approximately every 4-6 weeks throughout the study at a time convenient to you. I anticipate that seven interviews will be conducted lasting approximately 30 minutes each. These interviews will be recorded and transcribed.
2. Spend approximately 20 minutes after each interview reviewing the interview transcript. This will give you an opportunity to ensure that the interview transcript accurately reflects what you wanted to share and make any necessary changes.
3. Provide copies of relevant teaching materials, such as lesson plans, recorded lessons, and anonymized student work samples.
4. If you are willing, allow the use of professional social media interactions as data (e.g. Twitter or a blog).

Risks and Benefits: The risks in this study are minimal, if any. There may be a chance that reflecting on practice could be uncomfortable at times; however, usually such critical reflection is considered a benefit. Another benefit of participating is the opportunity to contribute to the advancement of knowledge while adding your voice to a description of technology integration in Manitoba Kindergarten-Grade 2 classrooms.

Voluntary Participation: Your participation in this research must be completely voluntary. If you decide to participate, you may withdraw at any time without any consequences or explanation. If you do withdraw from the study your data will only be used with your permission.

On-going Consent: To make sure that you continue to consent to participate in this research, I will review this information at the beginning of each interview session. You will have the opportunity to verbally provide your consent, which will be recorded and documented in the interview transcript.

Anonymity and Confidentiality: It is up to you if you would like to be identified in the research using your first name. If you do not feel comfortable using your own first name, you have the option to request anonymity through the use of a pseudonym. In this case, you would be referred to as Teacher A in School A. If you request a pseudonym, I will also assign one to your school principal. You will also have the opportunity to review the transcripts from the interviews in order to add, delete, or change responses. During the research, access to the materials will be limited to me, potentially my advisor, and possibly, a transcriber for recorded interviews. The transcriber, if one is used, will be required to sign a confidentiality agreement.

However, there are limits to confidentiality in this research study. Since two of the teacher participants will be located in rural Manitoba, the size of the sample from which participants are drawn may make it possible to identify individual participants. Participating teachers will have the ability to review all interview transcripts and delete any statements that make them uncomfortable to give greater control over the message that is disseminated.

No personal information about your students will be used in the data, and I will ask you to not mention specific students in interviews. Any inadvertent disclosures will be deleted from transcripts and not used. Additionally such disclosures will remain confidential.

All research data will be stored securely using Microsoft 365 OneDrive. The data will be stored for five years beyond the successful defense of my dissertation, then destroyed.

Dissemination of Results: Once my research is complete, findings will be shared in the following ways:

i) a written dissertation; ii) presentations at conferences such as Canadian Society for Studies in Education (CSSE); iii) my dissertation will be shared on the Internet (posted online at UVic Space, an open-access research repository); iv) media (such as the Manitoba Teachers' Society magazine); and v) shared directly with the participants or groups involved (more information provided below).

More specifically, to share with local participants: i) I will create an executive summary/Research Snapshot; ii) I will offer to lead presentations and workshops for superintendents, principals, school board members, and teachers that interweave research findings with relevant technology integration practices; and iii) I will share via social media including podcasts, Facebook/Instagram/Twitter posts, and blog posts on my personal account as well as educational accounts such as ManACE (Manitoba Association of Computing Educators) and BU Cares (Brandon University Centre for Aboriginal and Rural Education Studies).

Contacts: As a doctoral candidate, I am required to conduct research as part of the requirements for a Doctor of Philosophy in Curriculum & Instruction. It is being conducted under the supervision of Dr. Jodi Streelasky and Dr. Michelle Wiebe. In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria.

Should you choose to participate in this research, please sign the consent form, scan it and keep a copy for yourself, and email it to me. If you have any questions, I would be happy to arrange a video or telephone call to answer your questions personally.

Sincerely,

Devon Caldwell
PhD Candidate, University of Victoria

Appendix E

Letter of Information for Students' Families



**University
of Victoria**

Letter of Information for Students' Families

Purpose and pedagogy:

Teachers' use of technology in primary classrooms

Dear Families:

My name is Devon Caldwell, and I am a doctoral candidate in the Department of Curriculum & Instruction at the University of Victoria. I am also a practicing Kindergarten teacher in Fort La Bosse School Division in Oak Lake, Manitoba. I am writing to let you know about your child's teacher's participation in my dissertation research study. My research focuses on primary teachers' technology use, which may include technology-supported remote teaching activities during the pandemic. I am administering an online survey to all Kindergarten-Grade 2 teachers followed by case study research with two teachers from your local school division. To gain further information, I plan to review division policy documents related to technology integration and education during the pandemic. I fully understand that the current situation is uncertain and it is difficult to predict what will happen; as a result I plan to collect all data virtually without any in-person contact.

Research Project Title: Purpose and pedagogy: Teachers' use of technology in primary classrooms

Researcher: Devon Caldwell

Human Research Ethics Board Protocol Number: 20-0298-02

Purpose and Objectives: This study explores two questions through a mixed-methods case study design of four Kindergarten-Grade 2 classrooms in rural and urban Manitoba: (i) In what ways is technology being used in primary classrooms?; and, (ii) What are teachers' purposes for integrating technology? My research seeks to provide in-depth examinations of teachers' perspectives and rationales for integrating technology in their teaching practices.

Importance of this Research

There is a need for research in Manitoba that provides insight into how and why teachers of young children integrate technology. This research has the potential to inform professional learning opportunities, teacher education, division policy development, and planning for emergency remote learning. Rich descriptions of teacher practice can create models of innovation that other teachers can draw from to strengthen practice.

Participants' Involvement: Your child's regular classroom or remote learning activities will not be interrupted by this study. These methods of data collection will be used:

1. A series of online interviews with your child's teacher in which we discuss how and why they integrate technology in learning and teaching activities.
2. Your child's teacher will provide copies of relevant teaching materials, such as lesson plans and recorded lessons (if they are used).
3. I will examine student work that has been created with technology. The student work I see will be anonymized. That means your child's teacher will remove children's names and identifying information before sharing it with me. I will have no way to identify who produced the work.

Risks and Benefits: The risks in this study are minimal, if any. A benefit of your child's teacher participating is the opportunity to contribute to the advancement of knowledge while adding to a description of technology integration in Manitoba Kindergarten-Grade 2 classrooms.

Voluntary Participation and Consent: Participation in this research is voluntary. If you decide that you don't want your child's anonymized work samples shared with me, please inform your child's teacher and they will not share them with me.

Anonymity and Confidentiality: As previously mentioned, all student work will be shared anonymously. No personal information about your child will be used in the data, and your child's teacher will be asked to not mention specific students in interviews. Any inadvertent disclosures will be deleted from transcripts and not used. Additionally such disclosures will remain confidential. All research data will be stored securely using Microsoft 365 OneDrive. The data will be stored for five years beyond the successful defense of my dissertation, then destroyed.

Dissemination of Results: Once my research is complete, findings will be shared in the following ways:

- i) a written dissertation; ii) presentations at conferences such as Canadian Society for Studies in Education (CSSE); iii) my dissertation will be shared on the Internet (posted online at UVic Space, an open-access research repository); iv) media (such as the Manitoba Teachers' Society magazine); and v) shared directly with the participants or groups involved (more information provided below).

More specifically, to share with local participants: i) I will create an executive summary/Research Snapshot; ii) I will offer to lead presentations and workshops for superintendents, principals, school board members, and teachers that interweave research findings with relevant technology integration practices; and iii) I will share via social media including podcasts, Facebook/Instagram/Twitter posts, and blog posts on my personal account as well as educational accounts such as ManACE (Manitoba Association of Computing Educators) and BU Cares (Brandon University Centre for Aboriginal and Rural Education Studies).

Contacts: As a doctoral candidate, I am required to conduct research as part of the requirements for a Doctor of Philosophy in Curriculum & Instruction. It is being conducted under the supervision of Dr. Jodi Streelasky and Dr. Michelle Wiebe. In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria. If you have any questions, I would be happy to arrange a video or telephone call to answer your questions personally.

Sincerely,

Devon Caldwell
PhD Candidate, University of Victoria

Appendix F

Glossary

Technology Tools, Websites, and Devices

Name of Tool, Website, or Device	Description
Apple TV	A digital media player and streaming device designed by Apple to access movies, TV shows, and apps, or stream iPhone or iPad content on a TV screen or interactive display.
ChatterPix Kids	A simple and free photo editing and creation app by Duck Duck Moose. Students take or upload a photo, draw a line to make a mouth, and record their voices. Videos can be downloaded and shared to different platforms.
Chromebook	A small laptop that runs on a Google operating system and is mainly used for web-based applications and services.
Chromecast	An inexpensive streaming device developed by Google for casting or streaming content from phones, tablets, or computers to a TV or interactive display.
Code.org	A non-profit education website that provides access to computer science learning experiences and opportunities in schools. Teachers and students can access resources, lesson plans, and coding games, projects, and activities.
codeSpark Academy	A web and app-based coding curriculum that includes puzzles and games (such as The Foos) to teach the rudiments of coding. Available by subscription only, the site offers free coding activities for Hour of Code/Computer Science Education Week.
Epic	A free digital literacy platform where students can read and listen to thousands of books online or with the app. Teachers can create collections of books, assign reading materials, and monitor student progress.
Flip (formerly known as Flipgrid)	Acquired by Microsoft, Flip is a web and app-based tool that allows teachers to create collaborative groups and post topics or prompts for students. Students respond asynchronously using video, audio, or text messages.
Google Classroom	An online educational platform developed by Google to facilitate communication and collaboration between teachers and students, streamlining the process of creating, distributing, and grading assignments in a digital environment. It integrates many Google tools such as calendar, video conferencing, word processing, spreadsheets, and presentation software.
Google Maps	A web and app-based mapping tool that provides detailed and interactive maps, satellite images, and street views.

Name of Tool, Website, or Device	Description
Google Meet	A video conferencing and online meeting platform developed by Google formerly known as Google Hangouts. Integrated in Google Classroom, it allows users to conduct virtual meetings, conferences, and collaborative sessions with video conferencing, screen sharing, and messaging.
Google Slides	An online slideshow presentation software (similar to Microsoft PowerPoint) that allows users to create, edit, and collaborate on presentations.
HearBuilder	An app-based and online software program for Kindergarten-Grade 5 children designed to strengthen listening, auditory comprehension, phonological awareness, and memory retrieval. Available by subscription only.
iMovie	A user-friendly movie-making app available on Apple products that is designed for creating and editing videos.
iPad	Designed by Apple, an iPad is a tablet computer that features a touchscreen and portable design. Many free and paid applications (apps) are available from the App Store.
iPod	Designed by Apple and no longer in production, this portable media player stored and played digital music, videos, and podcasts, and also supported apps from the App Store.
Interactive whiteboard, panel, or display	An interactive panel or display refers to a display screen that is equipped with touch-sensitive technology, allowing users to interact with the content on the screen using touch gestures, such as tapping, swiping, and dragging. Some interactive panels may support digital inking as well as Internet, Bluetooth, USB, and HDMI connectivity.
Je Lis	An online levelled reading resource for Kindergarten-Grade 4 French immersion students. Teachers can monitor progress and assign text levels. Available by subscription only.
Kodable	Designed for primary students, Kodable is a web and app-based coding game designed to develop computational thinking skills in young children. Free and paid options are available.
Microsoft Teams	A collaboration platform and communication tool developed by Microsoft that was widely used during the pandemic. Microsoft Teams offers a wide range of features to support remote collaboration such as chat and messaging, video and audio conferencing, file sharing and collaboration.
Padlet	A free collaborative online bulletin board that allows participants to share, organize, and curate written messages, images, videos, music, files, and links. Padlet is available in web and app-based formats.

Name of Tool, Website, or Device	Description
ScratchJr	Designed for Kindergarten-Grade 2 students, ScratchJr. allows children to program their own stories and games using an introductory programming language. It is available as a free app for iPads, Android tablets, and Chromebooks.
Seesaw	Seesaw is a multimodal learning platform designed for student, teacher, and parent/guardian use (Seesaw: Where learning happens, n.d.). Free and premium versions are available that allow the creation, documentation, and sharing of work samples and learning portfolios. Communication and feedback are enabled through comments, teacher-parent messaging, and an integrated blog.
SMART Board	A brand of touch-sensitive interactive whiteboard manufactured by SMART Technologies . It combines a traditional whiteboard with interactive features, allowing users to control and interact with digital content using touch or a stylus.
SMART Notebook	Interactive educational software developed by SMART Technologies. It is designed to work in conjunction with SMART Board interactive whiteboards to create and deliver interactive lessons. SMART Notebook includes digital inking, a large resource library, and multimedia elements.
SplashLearn	A web and app-based tool for strengthening math and literacy skills through interactive games. Designed for Kindergarten-Grade 5 students, it is available at no cost.
Twitter (now known as X)	A social media platform that allows users to post and interact with short messages known as <i>tweets</i> that may include text, links, images, and videos. Twitter was acquired by X Corporation in April 2022 (owned by Elon Musk) and underwent a name change to X in July 2023.
Tynker	A coding curriculum that moves from block-based coding to more complex coding such as JavaScript and Python. Available online or as an app, Tynker offers free and subscription options.
YouTube	An online video-sharing platform that allows users to upload, share, and watch videos. Dr. Jean , Octonauts , and Wild Kratts are examples of popular educational video channels found on YouTube.
Zoom	Zoom is a platform that allows users to conduct virtual meetings, video conferences, webinars, and messaging. It gained widespread use during the COVID-19 pandemic for synchronous online teaching and learning.
Zorbit's Math Adventure	A game-based digital math learning program that offers individualized practice in an online or app-based

Name of Tool, Website, or Device	Description
	environment. Teachers can assign activities and monitor student progress. Available by subscription.
